POPULAR SCIENCE

Monthly

Nov. 1948

25¢



"Free-Piston" Power: Diesel's Newest Rival?

PAGE 98

IT'S FUN TO BE YOUR

and enjoy the home of your dreams!

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8½ x 5½ in.



with the aid of the

COMPLETE HOME

Here's How This Book Will Save You Hundreds of Dollars

THIS amazingly comprehensive volume shows you how to do yourself all of the jobs around the house that have long needed doing—and a lot more you've wished *could* be done. In simple, practical language and pictures it shows you not only how to make your own repairs on your Plumbing, Wiring, Electrical Appliances, Masonry, Plaster, Heating System, Furniture, etc., but also how to *make valuable improvements* in your home, from a new closet to a whole new roof—from a new floor to a whole new modern kitchen.

No longer need today's high labor costs keep you from having the kind of home you'll be proud of—attractive, smooth-running, free from hazards, and equipped with every comfort! This COMPLETE GUIDE makes even the most unfamiliar job easy to do—and *fun* to do! You not only save time and money, you also enjoy the thrill of watching your home acquire new luxury, comfort and value.

More than 1,000 "How To Do It" Illustrations!

300,000 Words! • 512 Pages

Here is Just a Partial List of the Hundreds of "How-To-Do-It" Articles in this One Book:

USE CONSTRUCTION AND MATERIALS

- w to Build a Foundation
- es of Girders and Sills
- ms and Floor Joists
- ding Materials
- es of Lumber
- fing Materials—
- sphalt, Asbestos,
- luminum, Wood
- hingles
- crete forms, mixing
- to Make All Types
- f Tinsmith Repairs

ERIOR REPAIRS

- airing Creaky Floors
- airing and Storing
- creens
- airing Windows—sash
- ord, windowpanes;
- osening stuck
- indows
- leum-laying, patching
- ng Loose Tiles
- ding China,
- etal Utensils
- airing Door Locks,
- inges
- Fighting Equipment
- ement into Game Room
- ling Partitions
- ng Hardwood
- oring, etc.

DECORATING

- papering
- ning Wallpaper
- ning Painted Walls
- iring Plaster
- Scraping Floors
- Refinishing Floors
- Care of Carpets and Draperies

PAINTS AND PAINTING

- Types of Paint Brushes
- Types of Paint
- Varnishes, Enamels
- Lacquers, Shellac
- Calcimine
- Paint Thinners
- Mixing Paints
- Surface Preparation
- Removing Paint
- Painting a New Surface
- Porch Floors and Steps
- Painting Metal
- Preparing Plaster
- Fillers, Staining, etc.



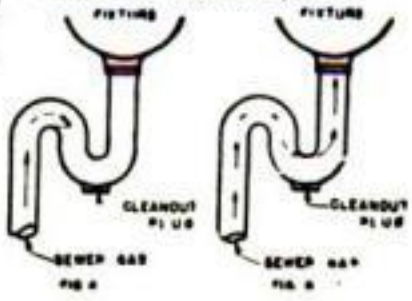
(Above) A simple little trick like knotting the wire inside extension plugs can save you severe burns, blown-out fuses, and fire hazards. Protect your home and family with the advice in this book!

ELECTRICITY IN THE HOME

- Approved Electrical Equipment
- Home Generators
- Fuse Boxes and Fuses
- Appliance and Extension Cords
- Replacing Fixture Sockets
- Electric Motors
- Home Signalling Systems
- Burglar Alarms, etc.

HEATING THE HOUSE

- Chimneys
- Coal Furnaces, Oil Burners
- Automatic Draft Regulators
- Thermostats
- Fuel Economy
- Warm Air Heating Systems
- Steam Heating Systems
- Cleaning, Adjusting Radiators
- Noise in Steam System



- Hot Water Heating System
- Repacking Leaky Valves
- Cleaning Boilers
- Cleaning the Furnace
- How to Insulate Your House
- How to Build and Install Storm Windows
- Efficient Weather Stripping, etc.

PLUMBING

- Water Supply
- Cause of Dirty Water
- Repairing Sewage System
- Cesspools, Septic Tanks
- Stopped Up Sewer Pipes
- Stopped Up Drains
- Chemical Drain Cleaners
- Plumbing Traps
- Noisy Plumbing
- Repairing Hot Water Tanks
- Thawing Frozen Pipes
- Water Softening Equipment
- Repairing Faucets, Flush Tanks, Leaky Pipes, etc.

EXTERIOR REPAIRS

- Waterproofing Damp Basements
- Waterproofing Masonry Walls
- Repairing Cracks in Foundation, Stucco Walls

(Left) You SEE diagrams that help you locate and, with little effort, fix plumbing noises, leaks, and drain stoppages.

- Repairing Brick Walls
- Repairing Leaky Roofs
- Caulking Seams
- Gutters and Downspouts
- Ridding the House of Termites, etc.

YOUR GARDEN

- Building Garden Paths
- Building Garden Pool
- Care and Use of Garden Tools
- Cold Frames
- Rustic Screens and Arches
- Building an Outdoor Fireplace
- Erecting Garage, Summer Guest House or Play House in Garden, etc.

Learn the correct way to care for brushes, tools, etc., to make them work better and last longer. This information in the book saves you money.



OWN HANDYMAN!

Here's Everything You Need to Know to Do Your Own Repairing, Beautifying, Modernizing, Converting! The A to Z of CARPENTRY, PLUMBING, PAINTING, DECORATING, WIRING AND APPLIANCES, MASONRY, FURNITURE REPAIR, HEATING SYSTEMS—*all in one book!*



HANDYMAN'S GUIDE

Make a New Kitchen, Game Room or Bathroom! Build an Extra Apartment and Live Rent-Free!

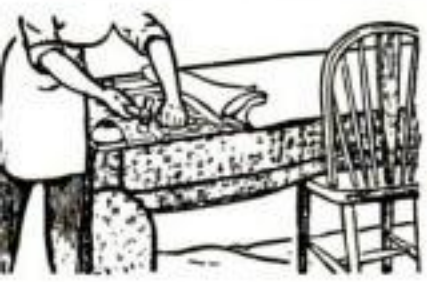
Here's 1,001 methods to help make your house more valeable—and add hundreds, even thousands of dollars to its value. Need new closet space? Want to eliminate that dangerous draft in the baby's room? Redecorate sister's room? Build a garden walk? Lay a new linoleum floor? Get better winter heat for less money?

Want to convert your basement or attic into an extra apartment and give yourself a rent income that may well offset a good part or all of your taxes, mortgage payments and other expenses?

You can make these improvements yourself, at surprisingly little cost, with the help of *The Complete Home Handyman's Guide.*

Easy Step-by-Step Instructions in Clear Pictures and Simple Text!

This book assumes no mechanical knowledge or skill on your part. It starts from the very beginning, explaining how to select and use tools and materials. It gives you detailed information every step of the way, from repairing a lamp or iron to installing a complete wiring system; from repairing a chair-leg to rebuilding your upholstery; from buying a paintbrush to repainting the house inside and out. More than 1,000 ILLUSTRATIONS, accurately and explicitly drawn, make the complete instructions easy to follow. This is the *number one* book for your home. It will repay its astonishingly small cost many times over within a short time!



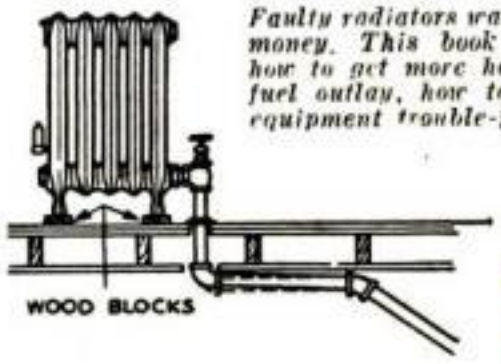
(Left) Furniture upholstery and repair is a fascinating and money-saving hobby when you follow the easy step-by-step instructions in this book.

FURNITURE CARE AND REPAIR

- Upholstery of Chairs, Sofas, etc.
- Replacing Worn Springs
- Strengthening Frame
- Furniture Upkeep, Cleaning, Removing Water Stains, Marks, Scratches, etc.
- Loose Joints
- Broken Chairs
- Polishes and Polishing
- Staining, etc.

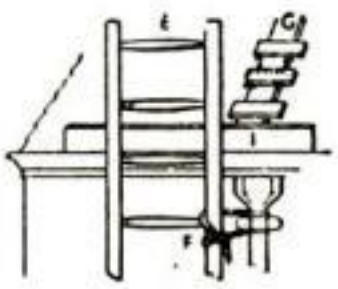
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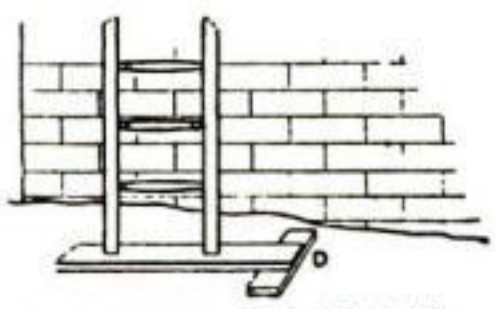
- Equipping Your Workshop
- Selecting the Right Tools
- Correct Use of Tools
- Care of Tools
- How to Sharpen Tools
- Sandpapers, Glues, etc.
- Soldering Equipment and Technique



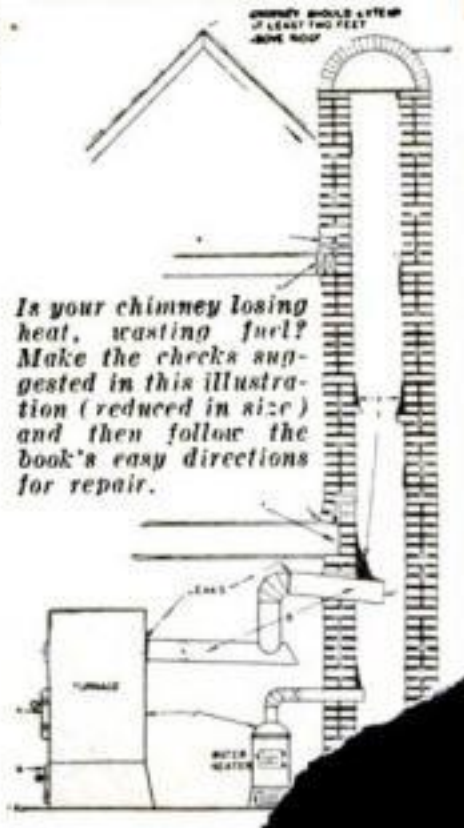
Faulty radiators waste heat and money. This book shows you how to get more heat for your fuel outlay, how to keep your equipment trouble-free.

How to equip a workshop, how to use all types of tools, how to use sandpaper and glues—all are fully covered in this "show-me-how" volume.





Avoid hazards. This illustration shows how to secure a ladder when you make roof repairs. Complete instructions for repairing walls, foundations, gutters, shingles, etc.



Is your chimney losing heat, wasting fuel? Make the checks suggested in this illustration (reduced in size) and then follow the book's easy directions for repair.

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POPULAR SCIENCE

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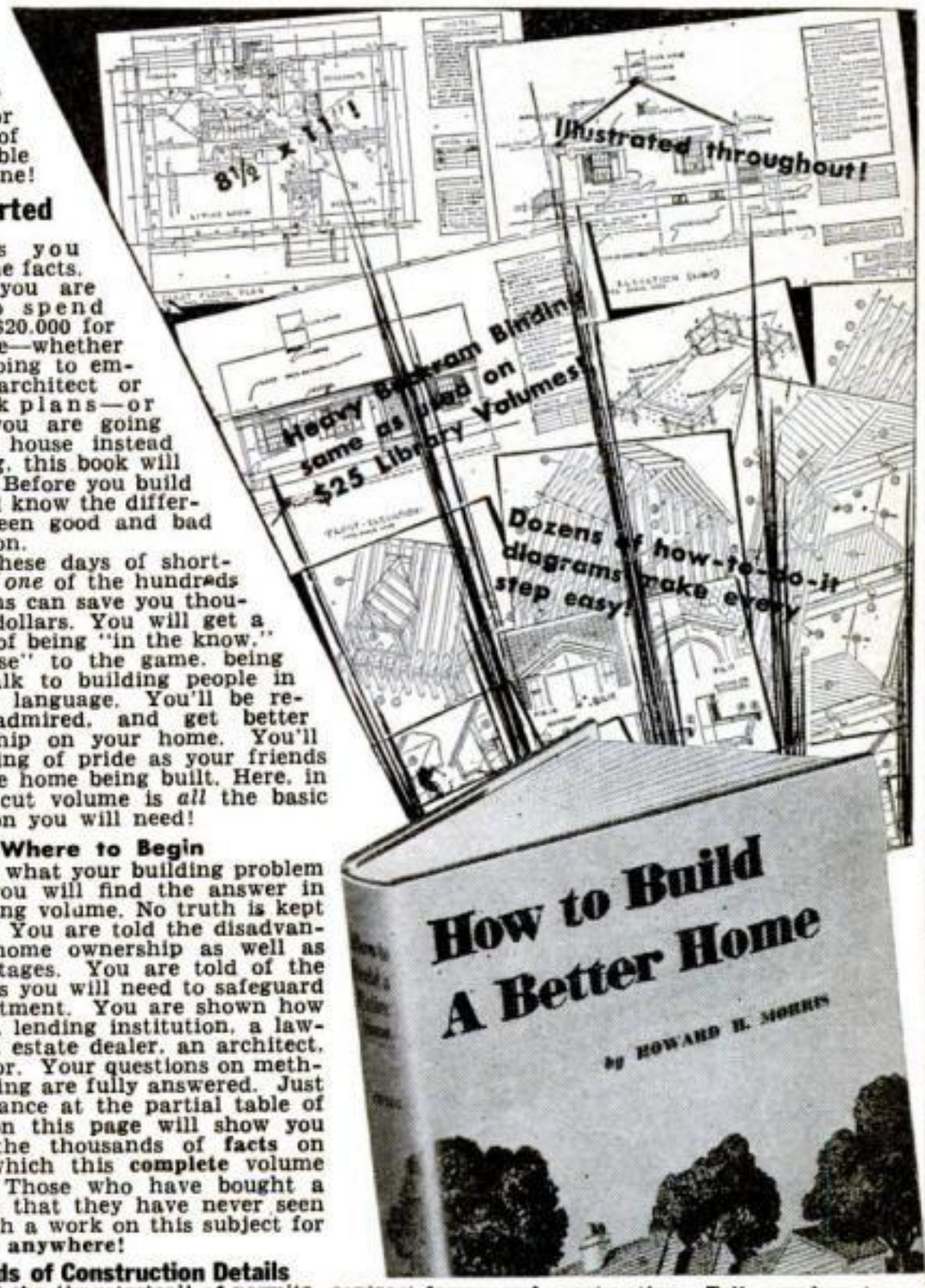
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- **HOW TO** fit your house to your income.
- **HOW TO** choose among types (prefabs, bungalows, one story, two story).
- **HOW TO** get started.
- **HOW TO** select professional services; real estate dealer; bank; attorney; contractor; insurance broker.
- **HOW TO** select a good building lot.
- **HOW TO** finance your home.
- **HOW TO** draw contracts.
- **HOW TO** use comparative costs in deciding—size, plan, design, material, finish and equipment.
- **HOW TO** prevent termites, cracks, leaks, decay and corrosion.
- **HOW TO** locate house on lot.
- **HOW TO** excavate.
- **HOW TO** get good masonry construction—footings, piers, basement, walls, chimneys and fireplaces, walks, driveways and terraces.
- **HOW TO** waterproof.
- **HOW TO** select good lumber.
- **HOW TO** frame.
- **HOW TO** roof.
- **HOW TO** select and install heating.
- **HOW TO** plan and install electric wiring.
- **HOW TO** insulate.
- **HOW TO** install plumbing.
- **HOW TO** lath, tile and plaster.
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- **HOW TO** paint and finish.
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Where to Begin

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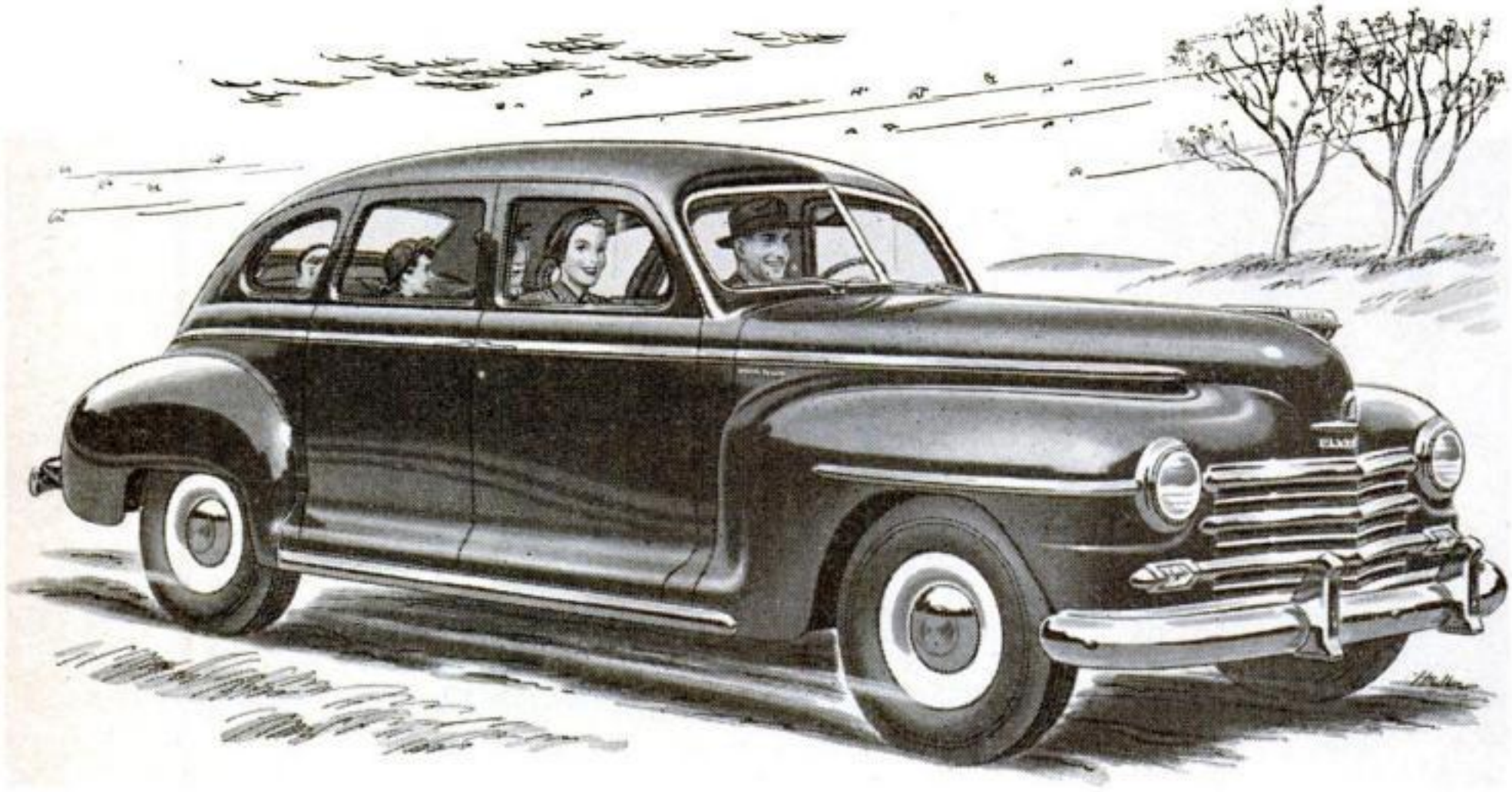
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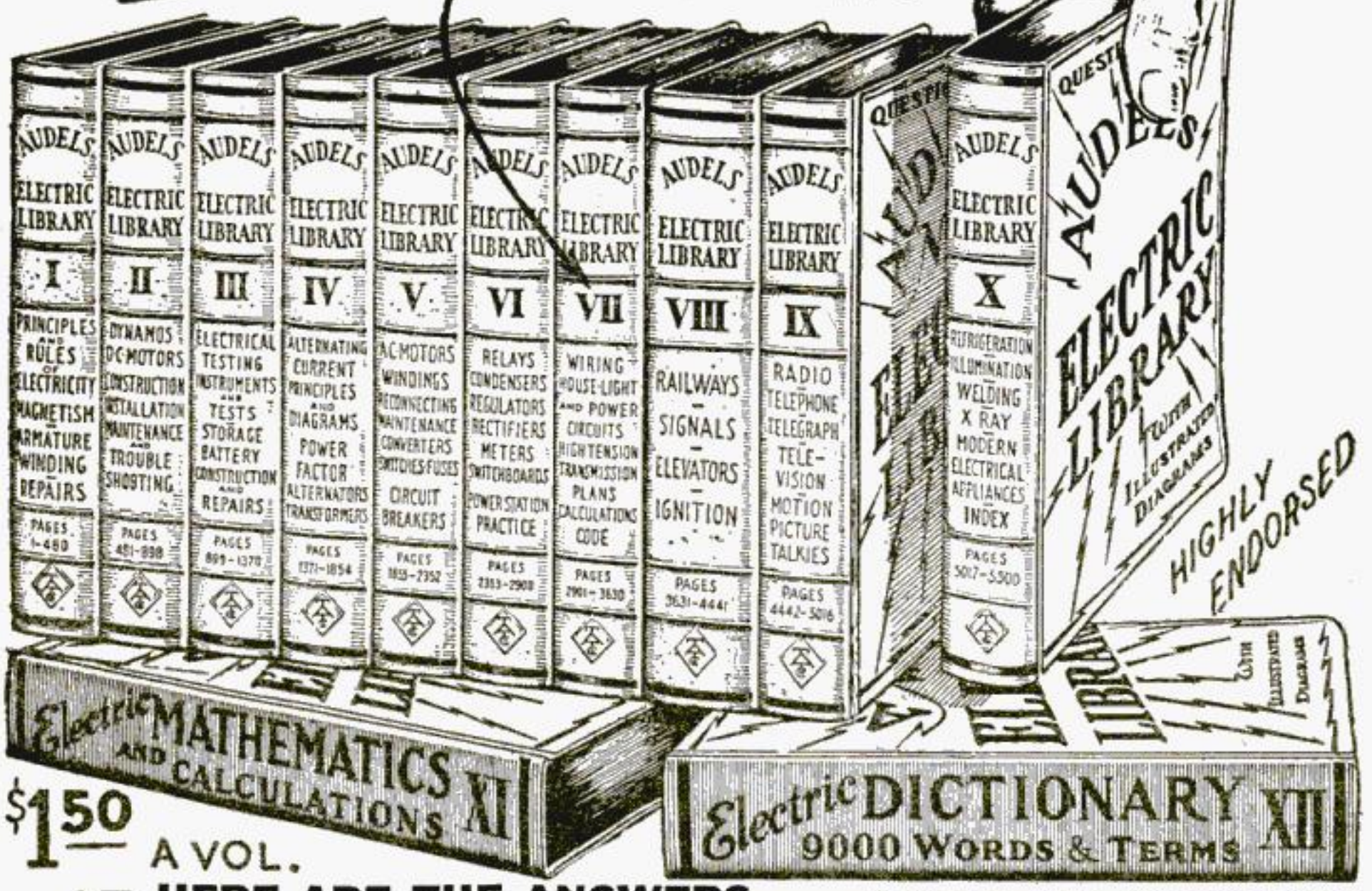
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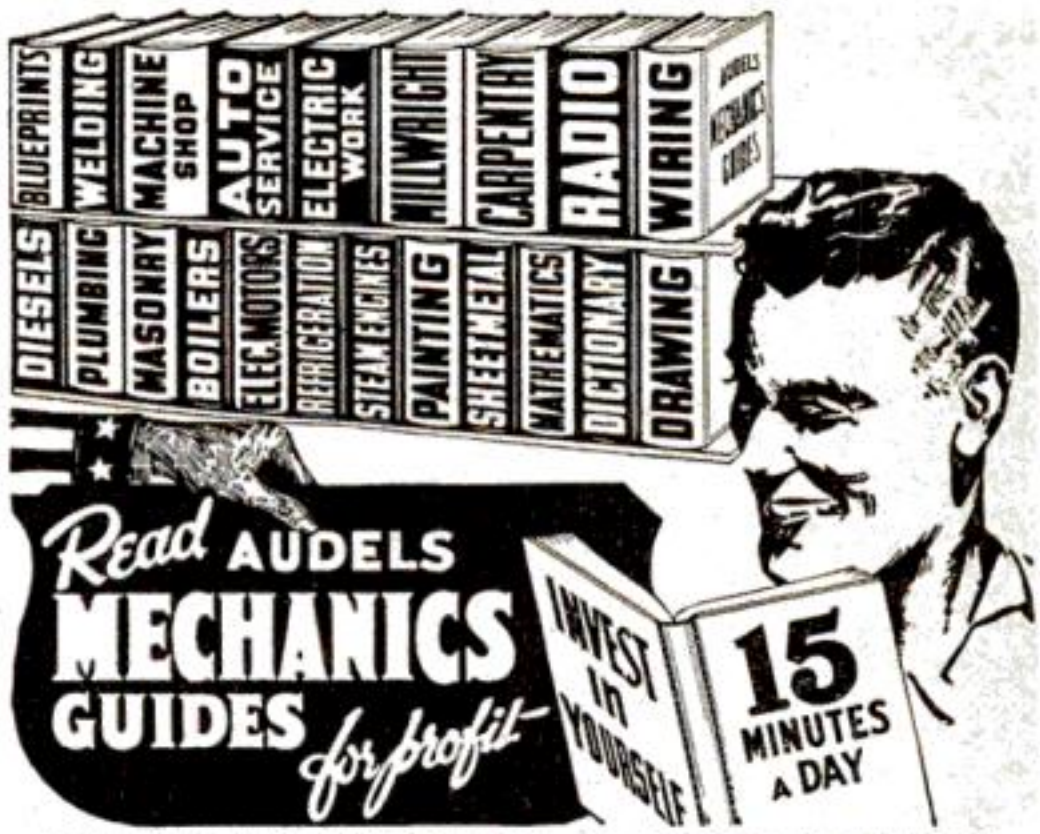
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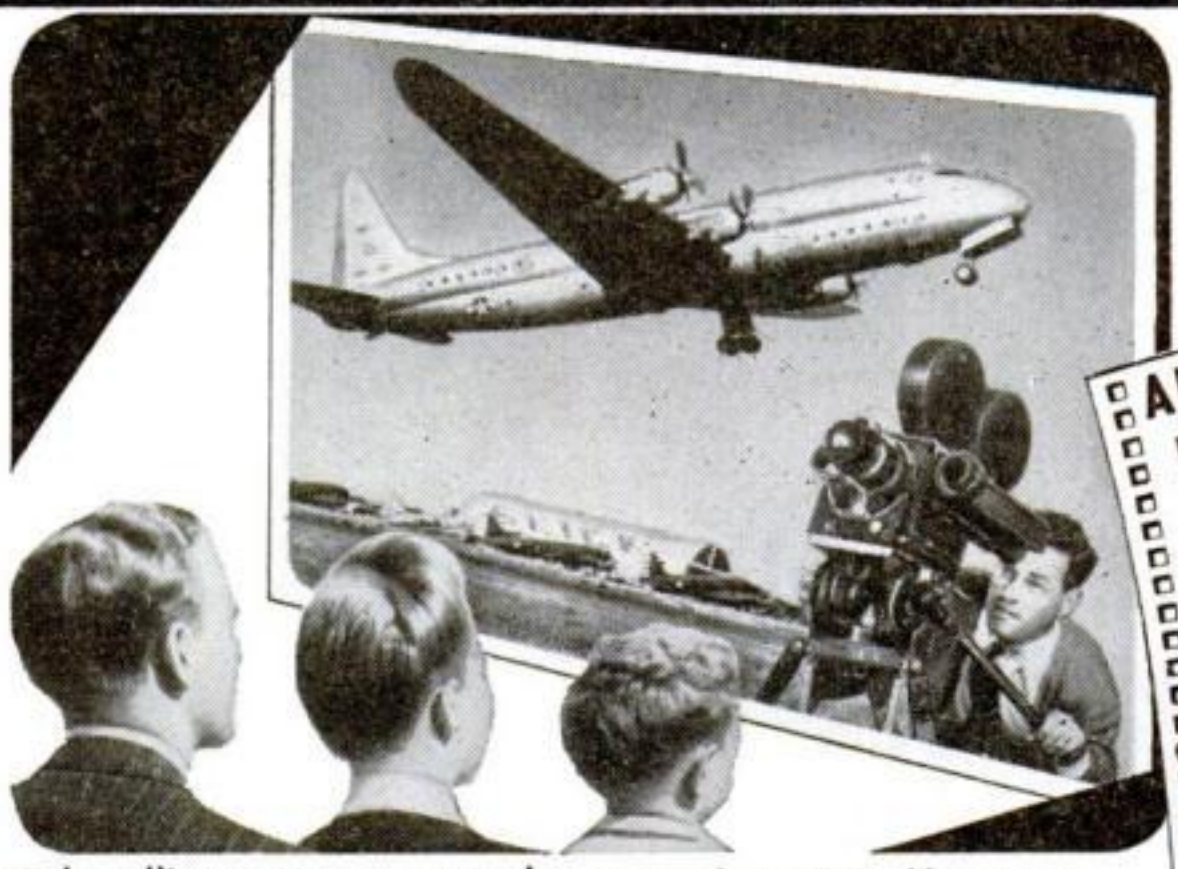
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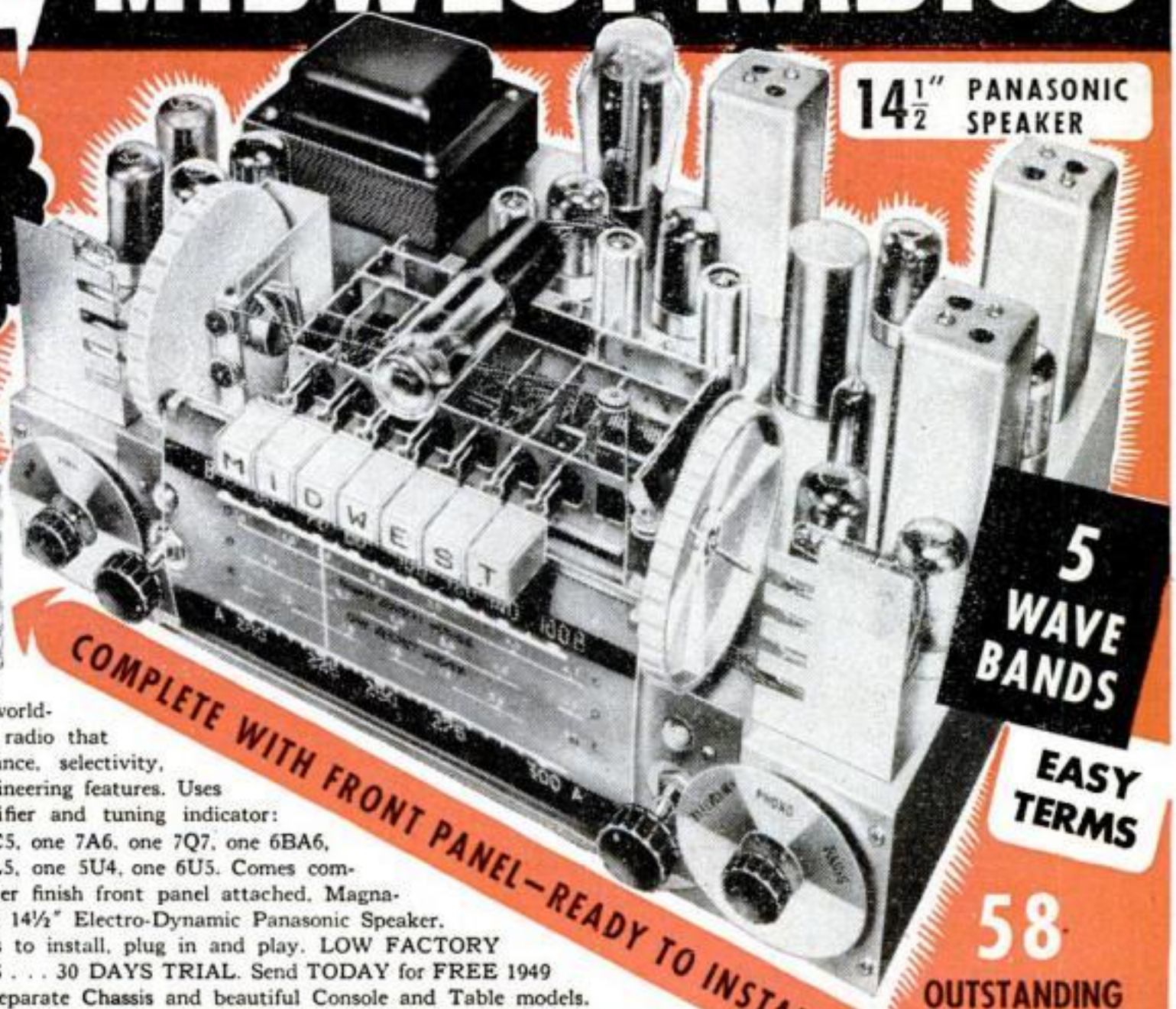
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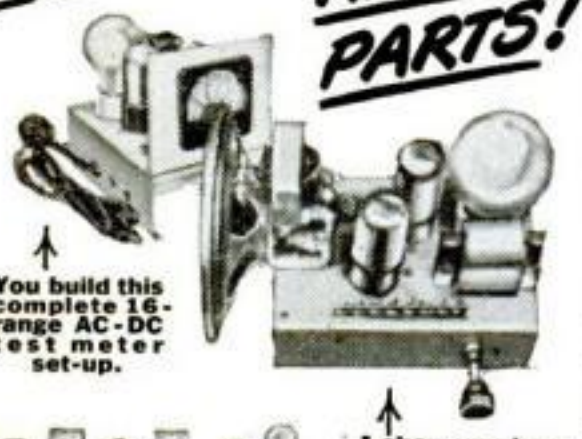
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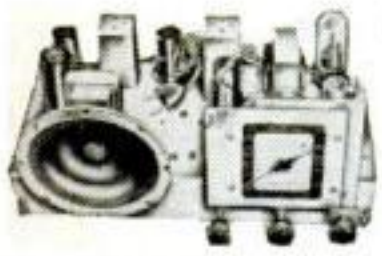
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A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

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Letters



Canned Television?

Sir:

Since television is now in use, I thought you might like the idea I have in connection with it.

As we all know, as long as we have records to play, we will always want to listen to our favorite music.

Now with television, I think it would be possible to have the players and singers televised on the records. In that way, you'd not only hear them but see them. . . .

C. WOJTENA

Whiting, Ind.

*A **good** idea, but pretty hard to work out. It is interesting to note, however, that facsimile images have already been recorded on wire for later transmission, the visual image being produced entirely by sound. A major difficulty would be to get both the sound and the image from the same record. Perhaps two synchronized records, one providing the image and the other the sound, might be one answer. In any case, though, the cost and complexity of the equipment required, both to record and play back the records, would probably rule out commercial development for some time to come.*

Atoms vs. Steam

Sir:

What is the matter with the current writer on atomic energy? Has he lost his imagination? To me—I am just an ordinary electrician—imagination is an indispensable quality. Why should anyone with the ability to comprehend, and write about, power plants, ocean liners, aircraft, and many other devices powered with atomic energy still go back to the steam era?

All of the proposals I have seen have been in this vein: atomic energy to be transformed into steam pressure; steam pressure to drive a turbine or, even less, an inefficient reciprocating engine; and that, in turn, to drive an electric generator. It seems to me they are missing one of the first concepts of physics, due perhaps to the magnitude of the subject. With every transformation of energy there is a loss due

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to the escape of heat, gases, chemicals, radiation, by-products, etc.

With a working knowledge of atomic fission plus a little imagination, it seems to me to be entirely possible to convert atomic energy, with its billions of electron volts (which I confess I do not understand), its free electrons, its beta and gamma rays, its radio activity, etc., directly into electrical energy. I believe that electrical energy is, so far, the most efficient and workable means of transforming energy into everyday uses. Modern science easily and efficiently transforms electricity into mechanical energy, heat, light, chemical, and electronic energy. . . .

A. M. KIRKPATRICK

Sacramento, Calif.

Drawing electricity directly from an atomic pile is a nice idea, but unfortunately nobody has thought of a way to do it. PS mentioned this problem about a year ago ("Artillery Against the Unknown," July '47).

More recently, Dr. Lyle B. Borst, head of the nuclear reactor project at AEC's Brookhaven National Laboratory, said: "We have looked long and hard for a trick method of getting electrical energy directly from the chain reaction. We would greatly enjoy building a chain reactor with two wires leading out to carry away the energy at a modest voltage of a million or so volts . . . We can even dream up a system (with) reasonable efficiency . . . (but it) will not support a chain reaction."

There is some promise in MIT's new high-efficiency thermocouples, which convert heat directly into electricity, but the best are inferior to a good steam plant.

Wishing Well Works Well

Sir:

In the April '48 issue, page 191, you gave the directions for making a Wishing Well flower pot. I made one for my wife, and since then I have made 70 or 80 for our friends who have seen it. They are the prettiest flower pots I have ever seen.

I made a few changes in the process that may help others in making them. For the roof I used a slat from an old venetian blind, instead of a cigar box. I didn't have the tools for tin work, so I used a cork for the bucket, which I hollowed out. After it has been varnished it looks like an old wooden bucket. Thanks for the complete plans of

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an original idea, and I hope there will be many more to follow.

R. L. SOUTHWICK

Tampa, Fla.

Seeing a Molecule's Shadow

Sir:

In the article "Super Microscopes to Open New World" [PS, July '48, p. 122] there is a photograph showing a molecule of polystyrene latex. The photograph shows a definite shadow cast by the molecule.

I would like to know if this is possible. It seems to me that the electron microscope could not reproduce anything such as a shadow. And even if it could, the wave length of visible light would be longer than the diameter of the molecule, making it impossible for the molecule to cast such a shadow. . . .

RICHARD S. SAKURAI

Portland, Ore.

The shadow is not an optical one, as Mr. Sakurai correctly reasons. It is the result of a technique often used to enhance the clarity of images in the electron microscope. In preparing the specimen for examination, it is subjected to a "sputtering" of chromium or other metal, of which a thin film is deposited. High points on the specimen shield nearby areas and leave uncoated spots resembling shadows. The photograph is an example of this very striking effect.

Landing the XB-48

Sir:

In your October, 1947, issue you ran a picture of the Martin XB-48 six-jet bomber with bicycle landing gear. I have been puzzling, on and off, ever since about how an airplane with fore-and-aft wheels is landed. Do you land it on the front wheel first, the rear wheel, or both at once?

JAMES CHRISTENSEN

St. Louis, Mo.

Good question. The ideal landing is one made at approximately 10 percent above stall speed, which allows both wheels to touch simultaneously. A full stall landing may also be made, allowing the rear wheel to touch first, or a high-speed, nose-wheel landing, which is similar to landing on conventional gear. In a high cross wind, the up-wind wing must be kept level or slightly

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down. This same problem exists on a flying boat, but is quite easy to control.

500 Bird Cages?

Sir:

In the August number of PS, page 175, a writer says to keep birds away from strawberry beds by putting bird cages over the plants. What a joke. I have 500 plants in my strawberry beds . . . 500 bird cages?

Here is my plan, and it works. Get an old, worn-out garden hose, cut it into 3-foot lengths, and put these between the rows, about 10 feet apart. To the birds, these are snakes, and you should see the robins and other birds as they roost on the wire fence and never go near the berries.

MRS. L. M. MITCHEL

Toledo, Ohio

Thermometer Gets a Cold Shoulder

Sir:

I have been told that a reliable method for testing the accuracy of an ordinary thermometer is to place it in a pan of cracked ice—that under this condition it should register 32 degrees. . . .

LESLIE M. PINNEY

New Castle, Pa.

Yes, but adding a little water to the ice will make it easier. Don't worry about melting the ice—ice melts at 32° F.

Puzzling Projectiles

Sir:

My friend contends that two identical projectiles, one fired on a horizontal and the other dropped from an equal height at the same instant the first leaves the muzzle of the gun, will both reach the ground at the same time.

I say that this is only true in theory. In actual practice it would not work out, due to air pressure, muzzle velocity, and other governing factors.

ARTHUR C. BECKER

Woodhaven, N. Y.

Mr. Becker's friend gets the decision on this one. The falling or vertical motion of each projectile is due to gravity alone and thus is entirely independent of any horizontal motion; so the projectiles would strike the ground at the same time.

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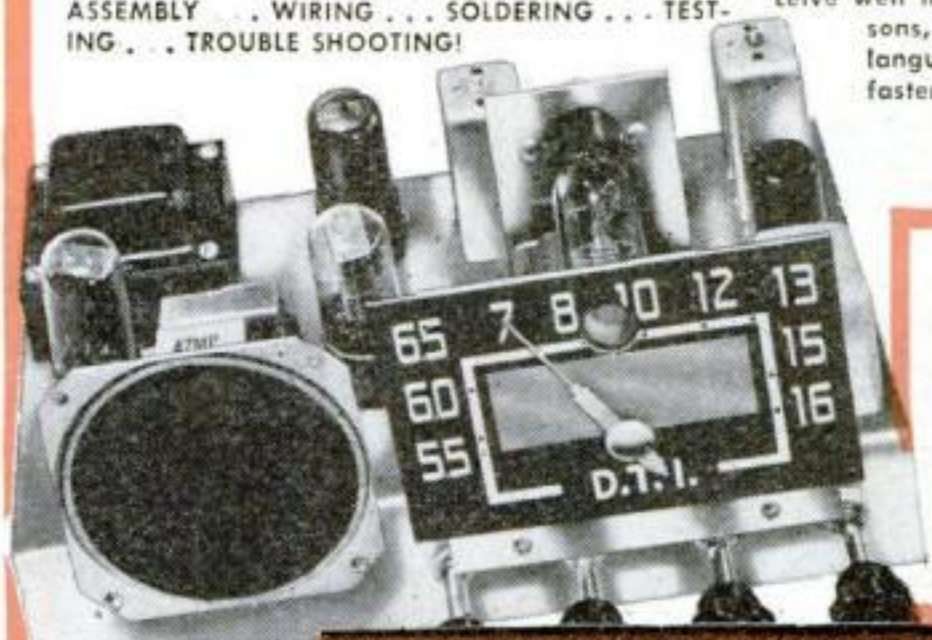
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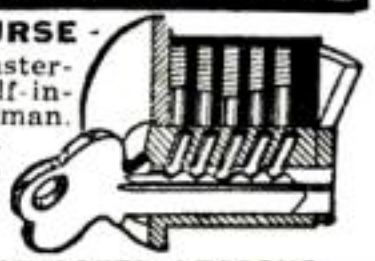
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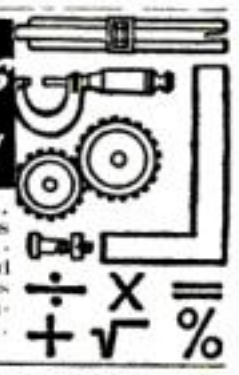
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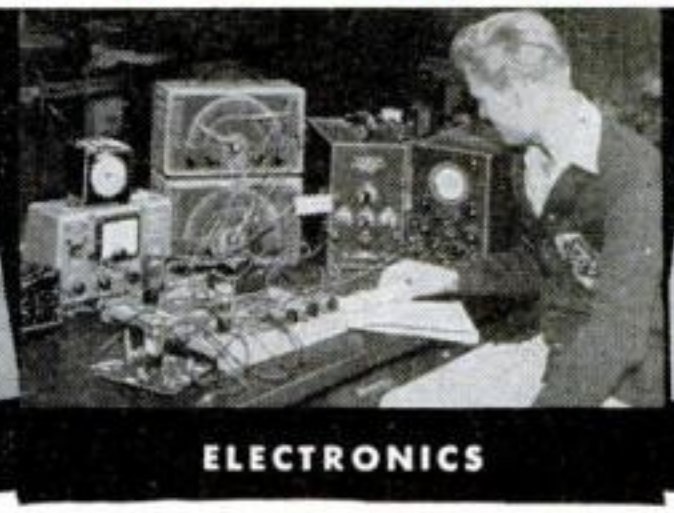
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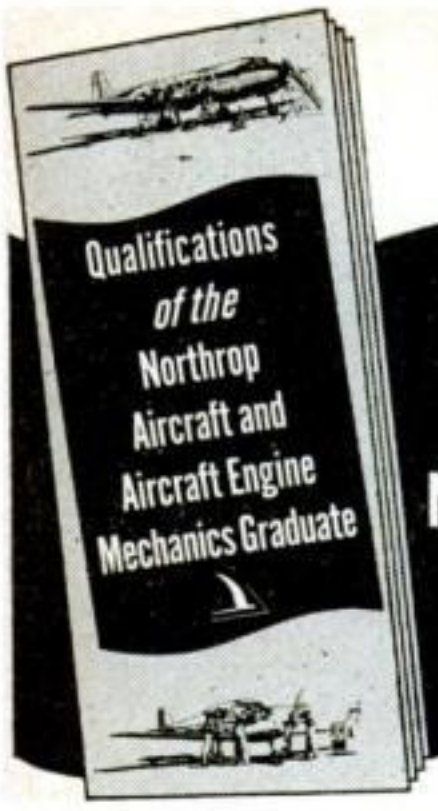
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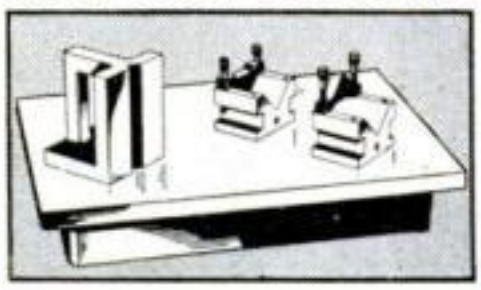
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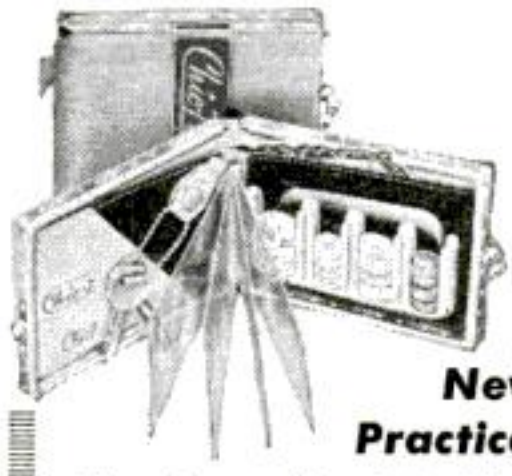
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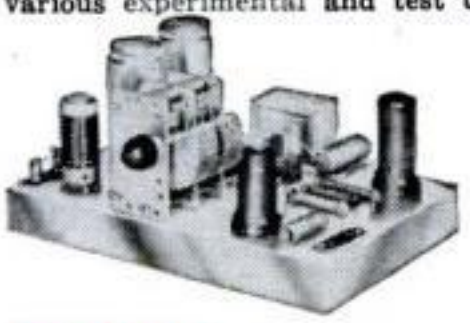


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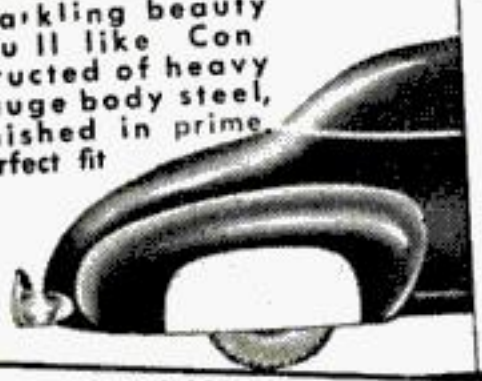
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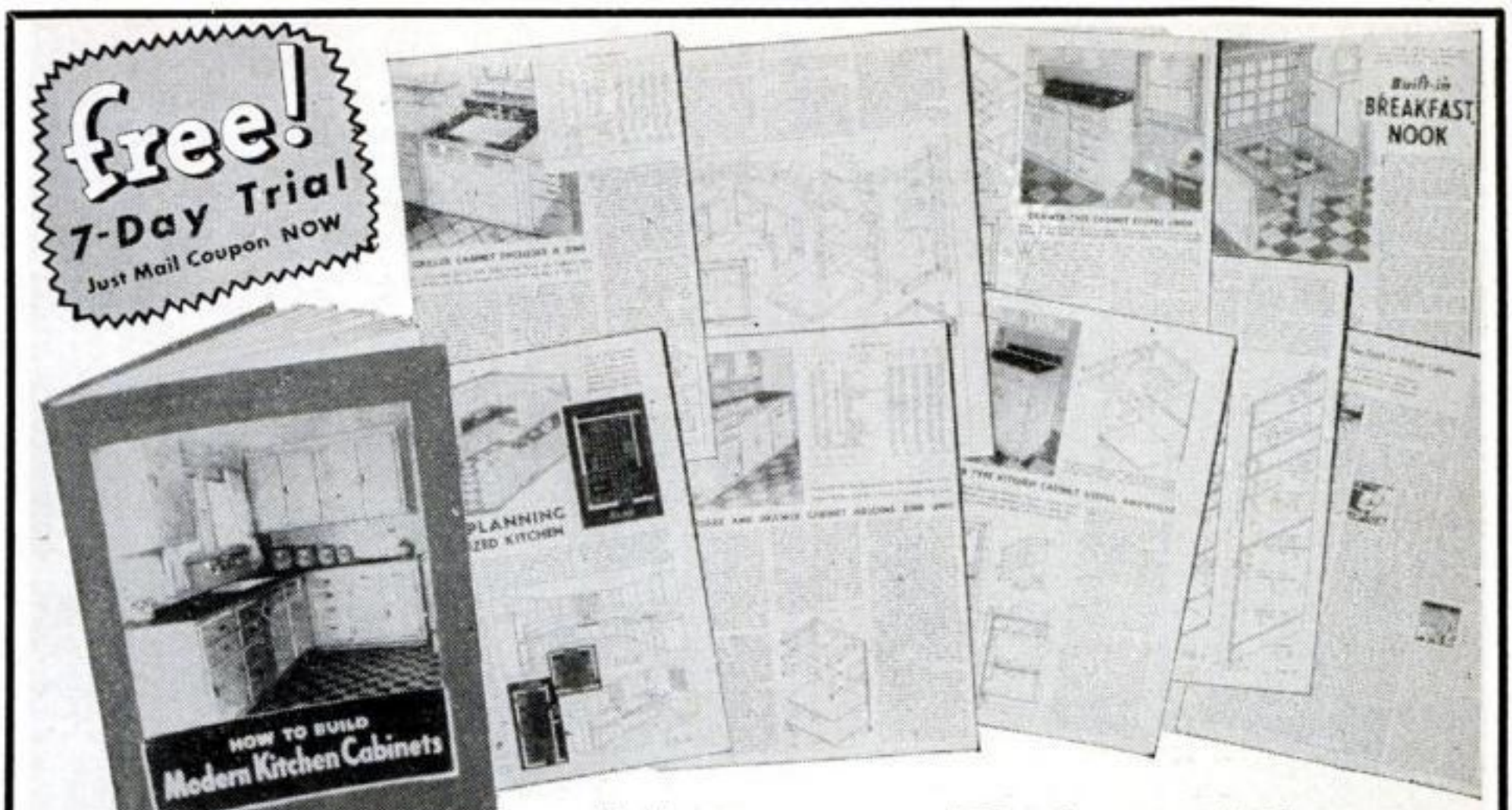
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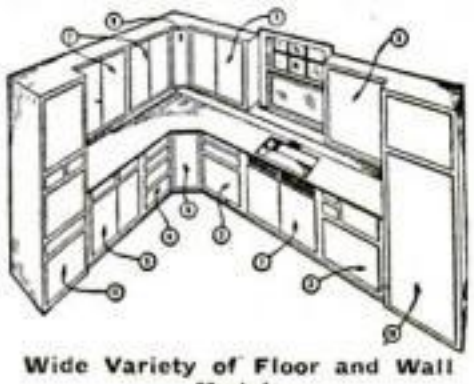
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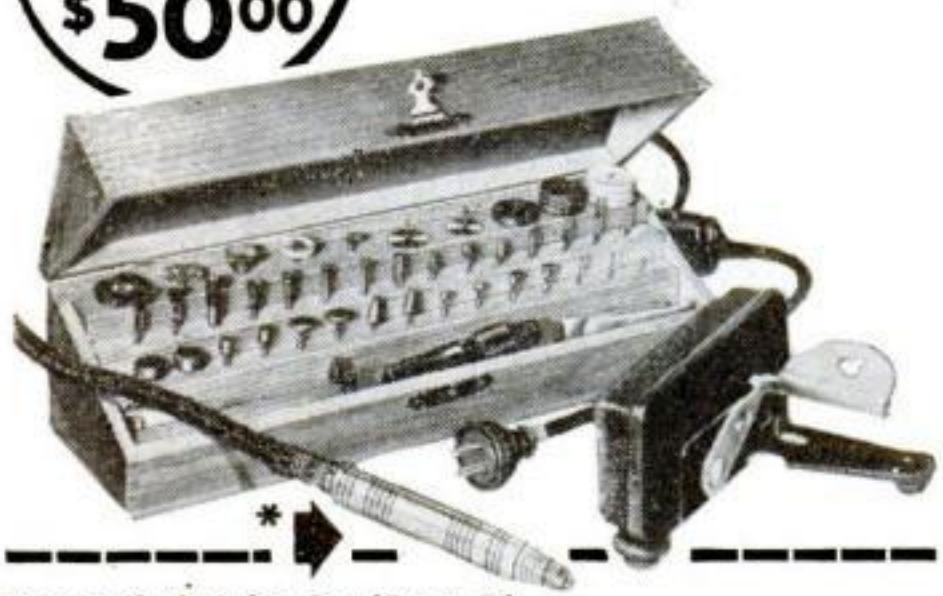
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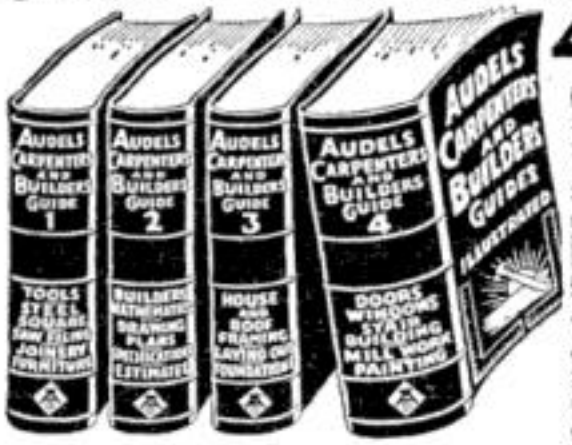


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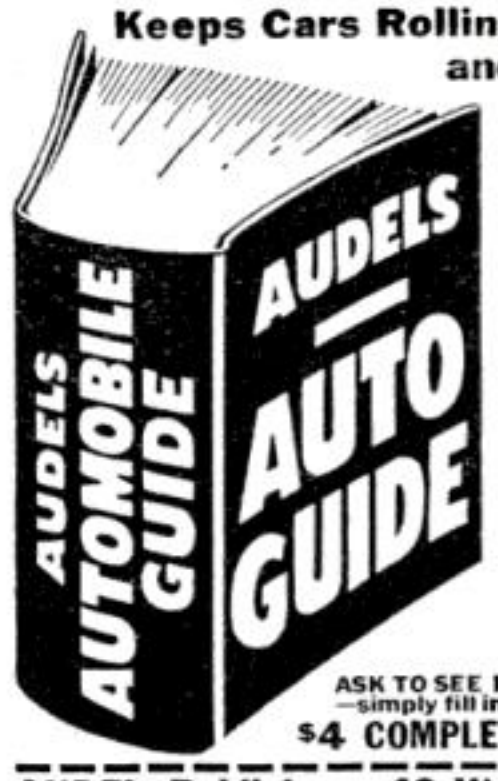
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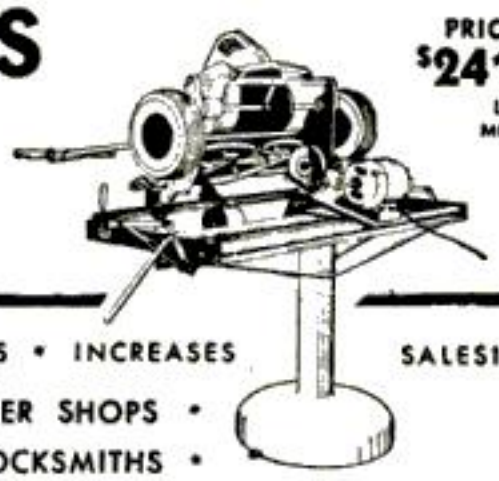
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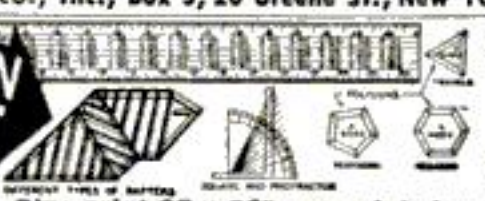
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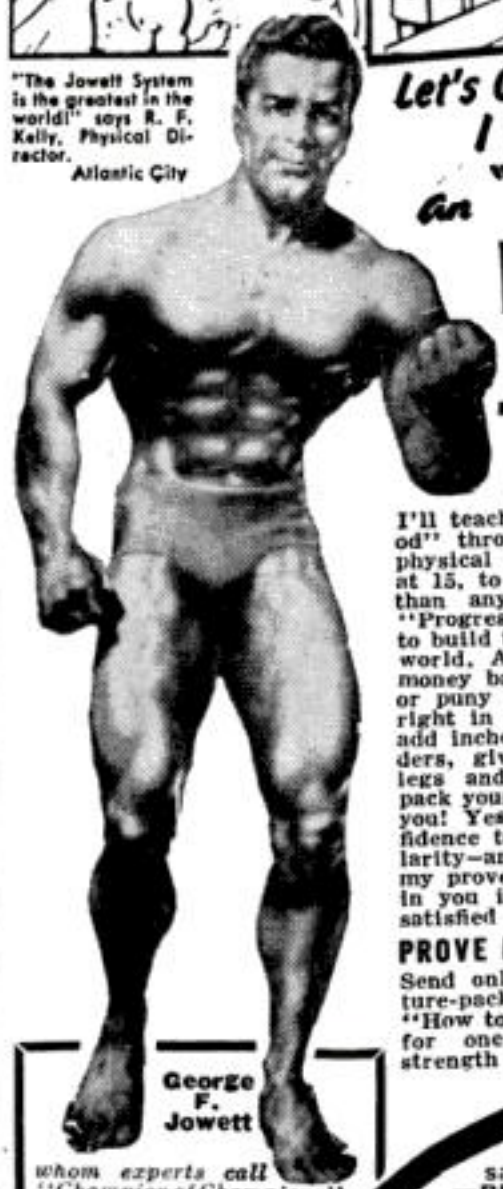
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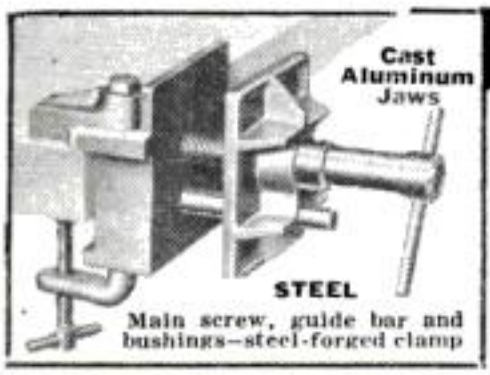
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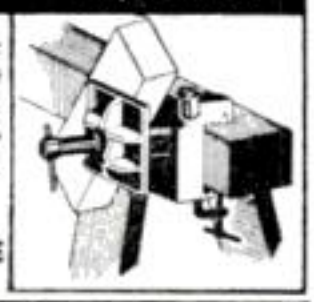
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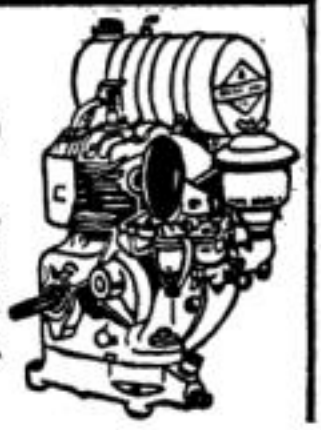
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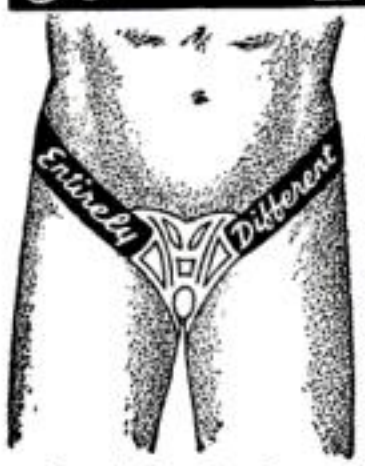
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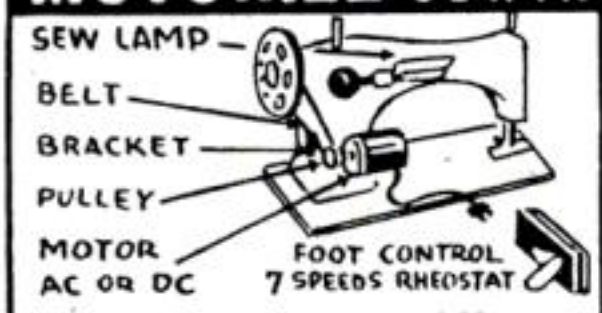
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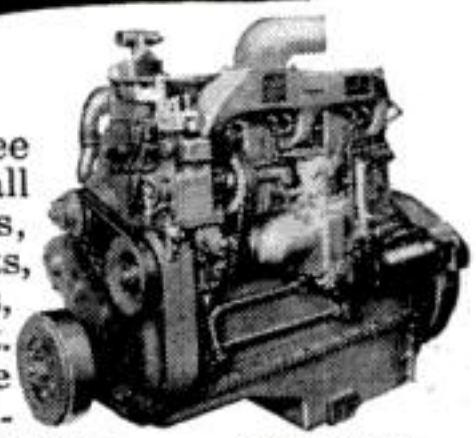
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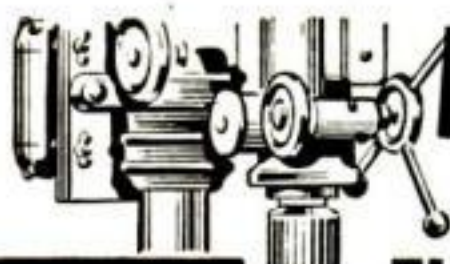
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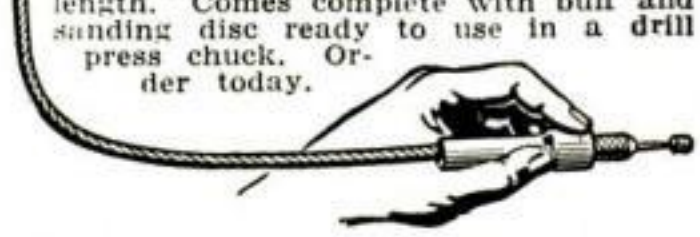


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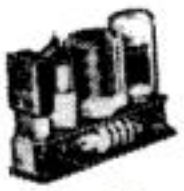
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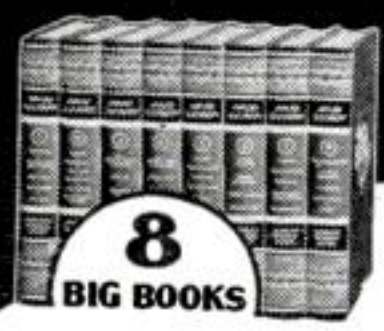
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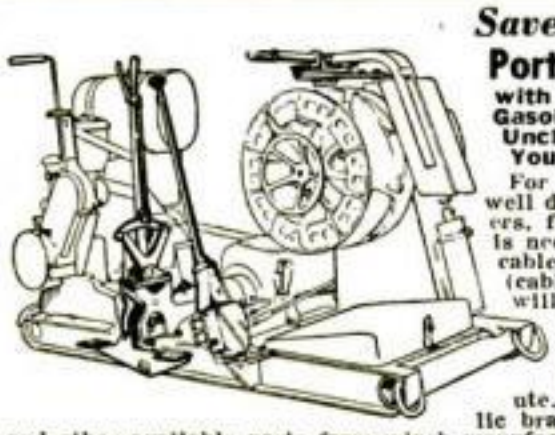
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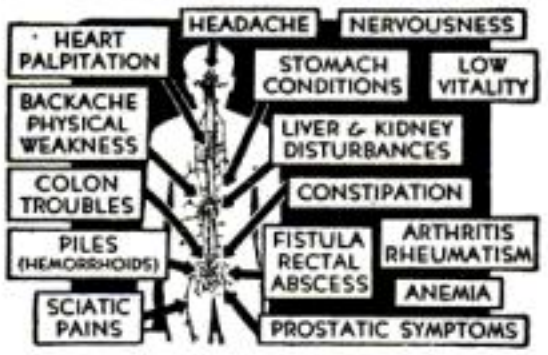


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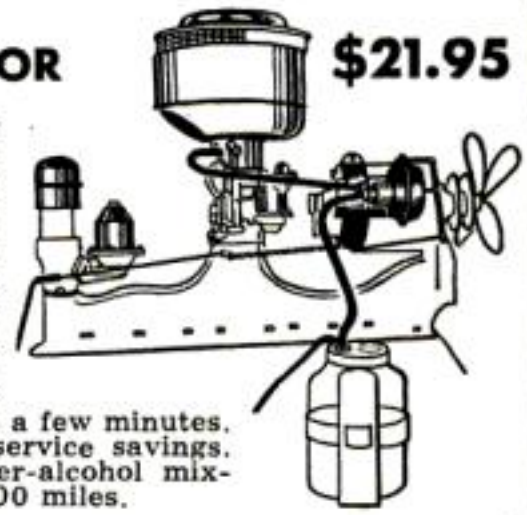
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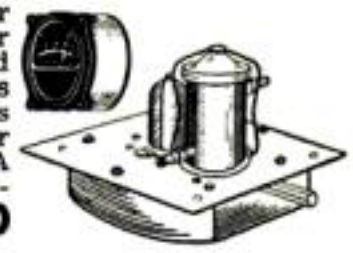
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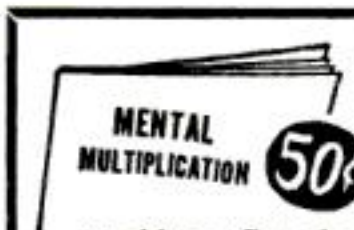


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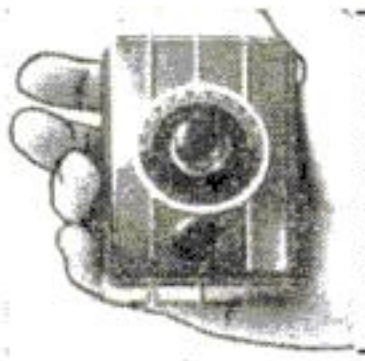
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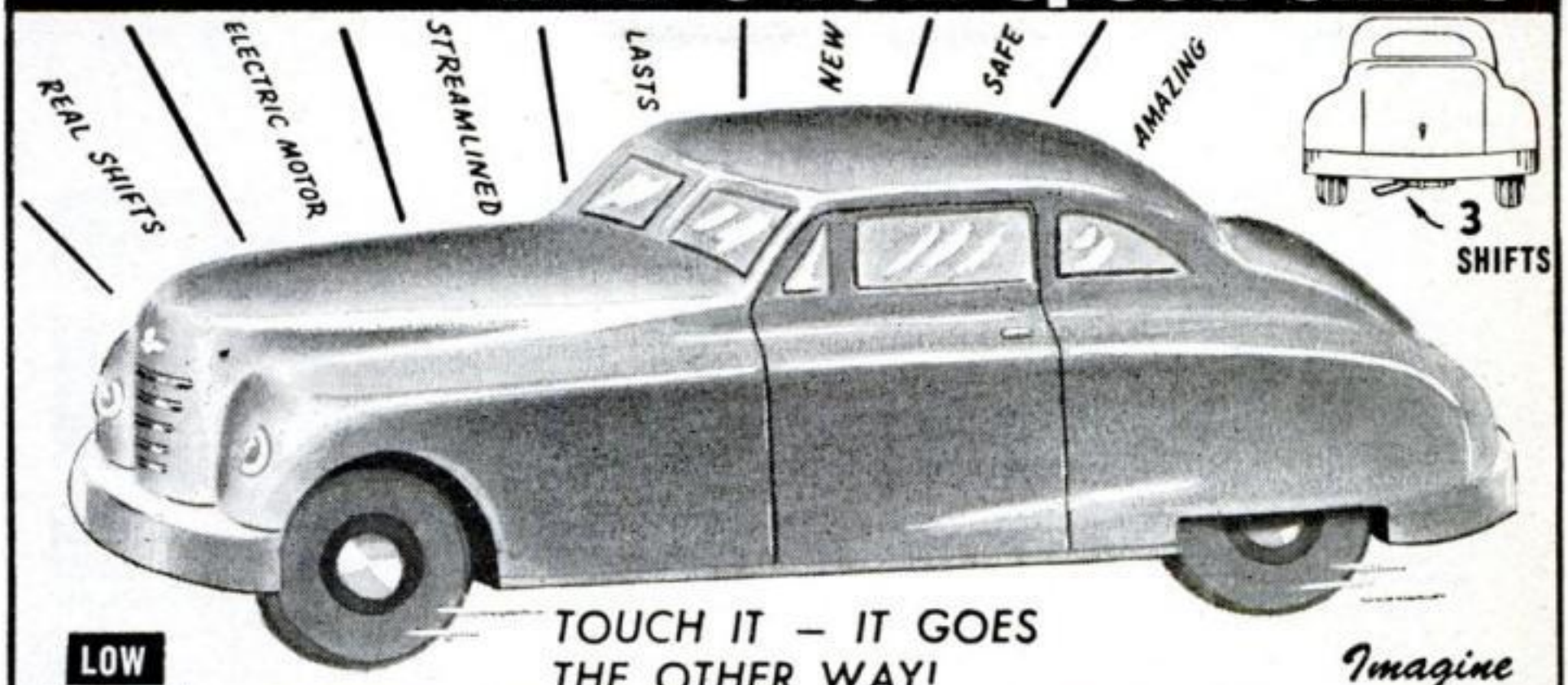
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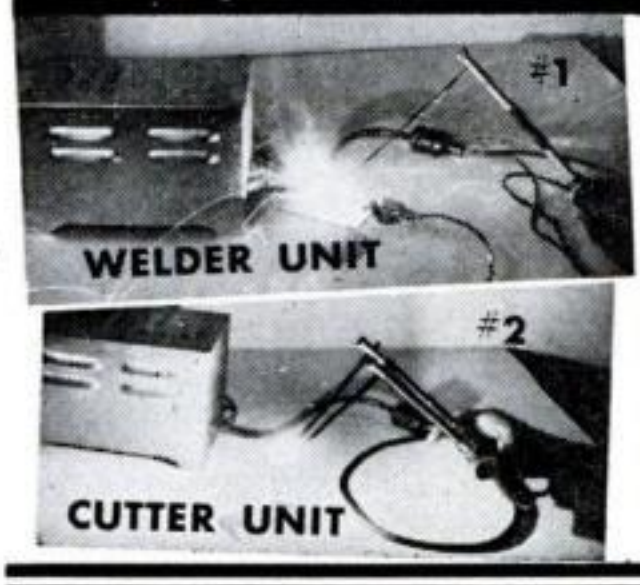
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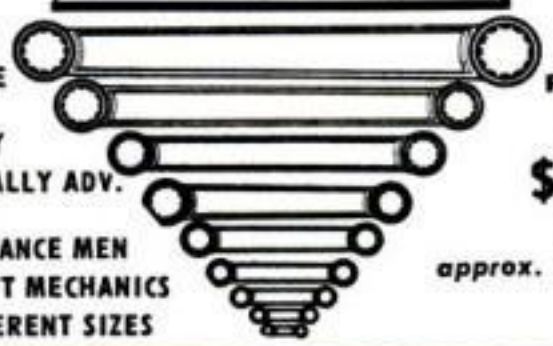
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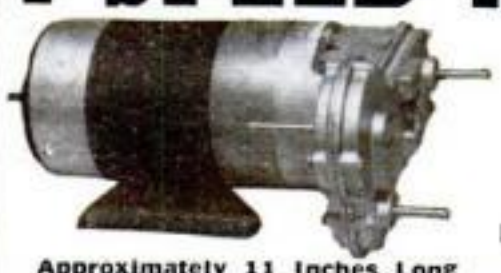
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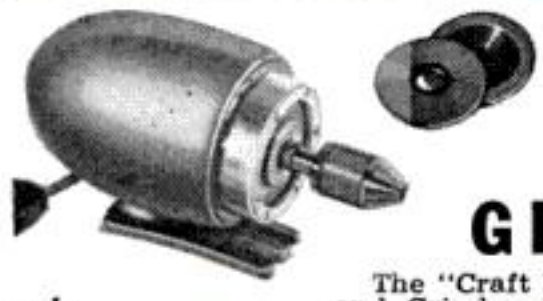
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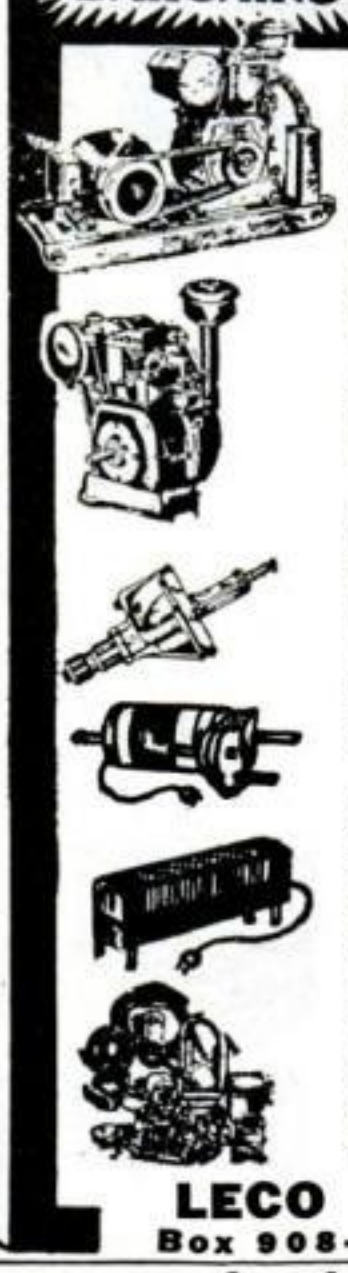
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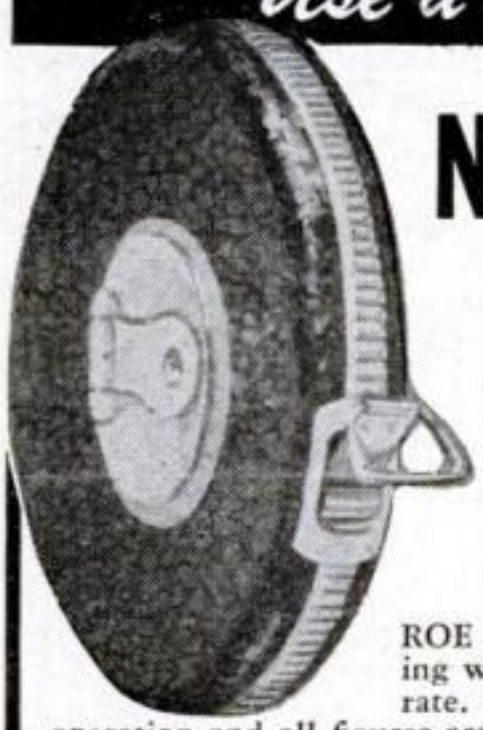
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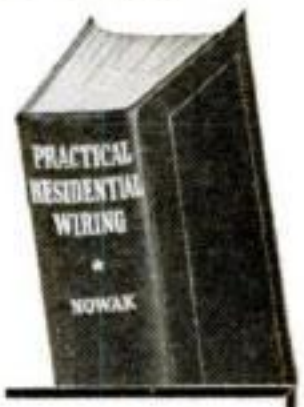
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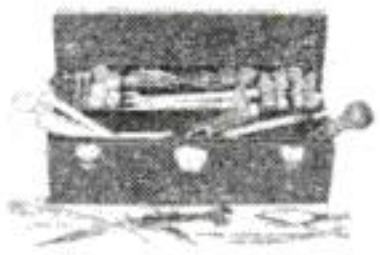
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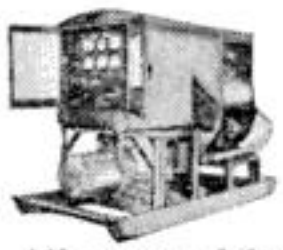
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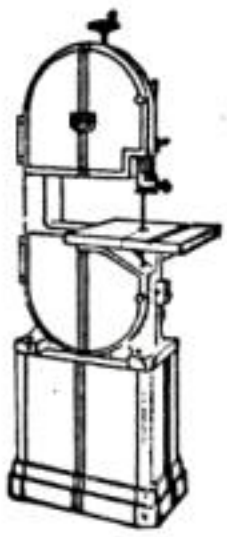


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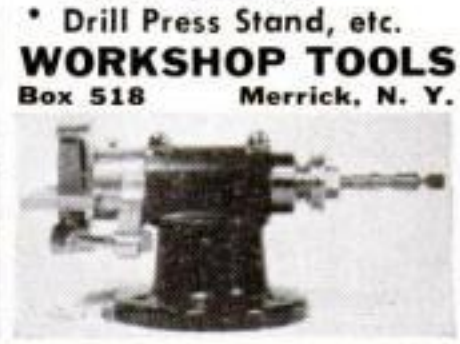
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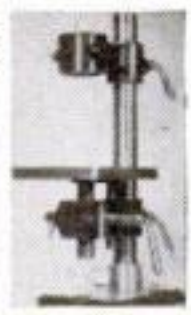
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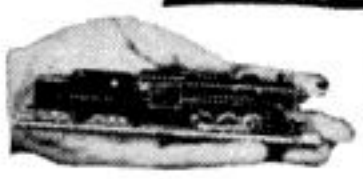
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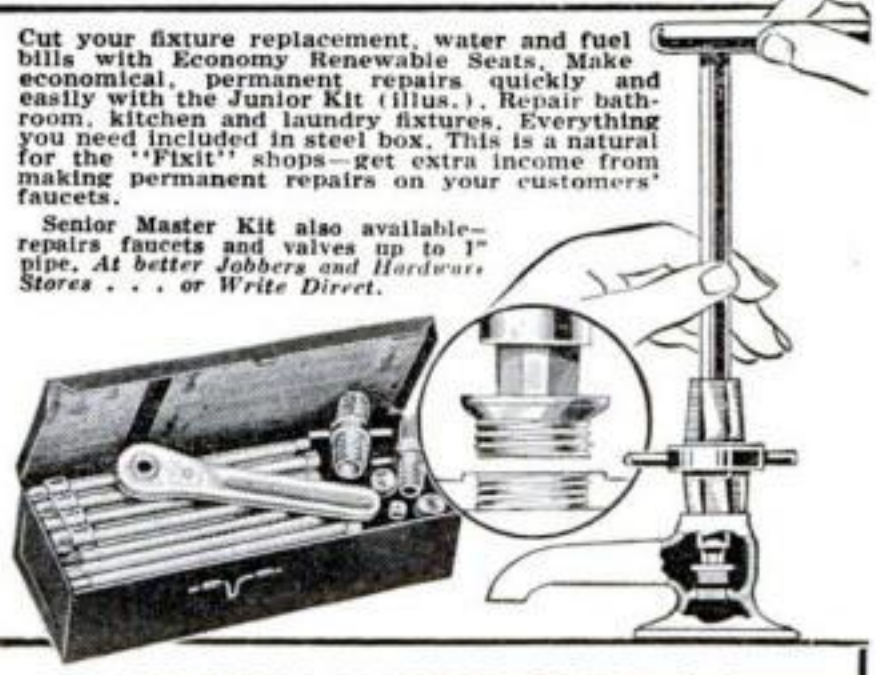
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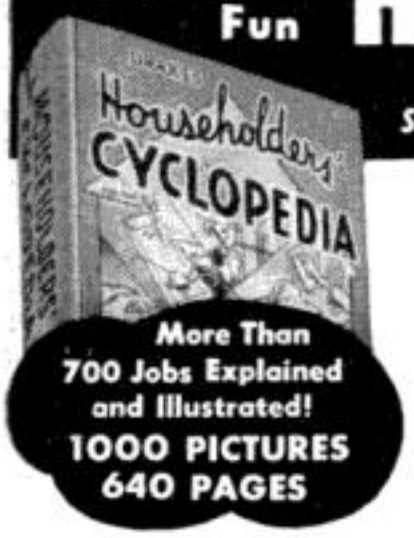
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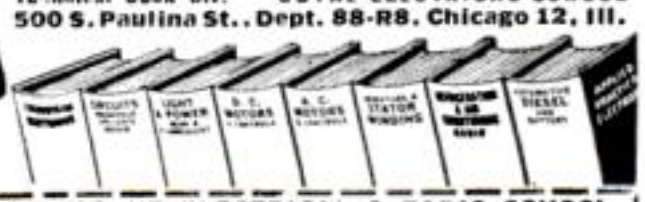
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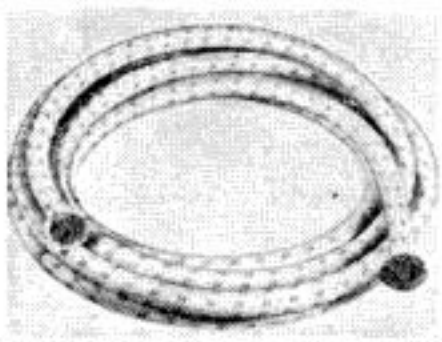
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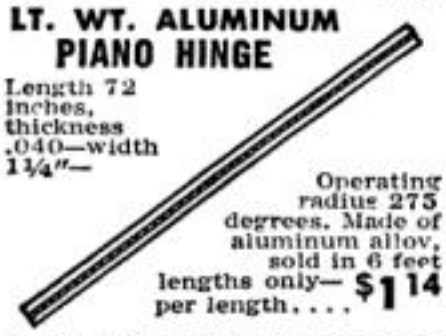
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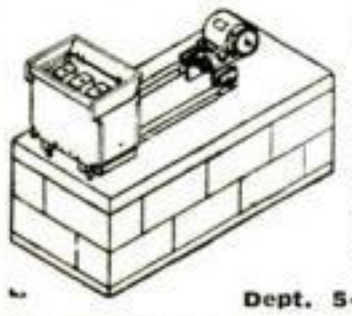
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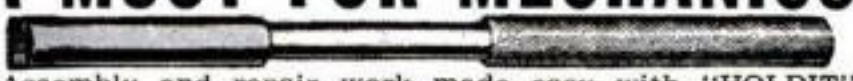
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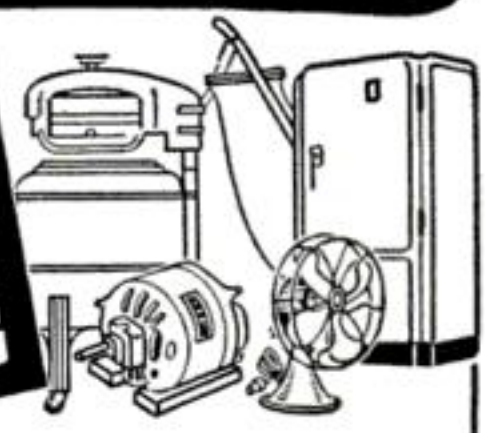
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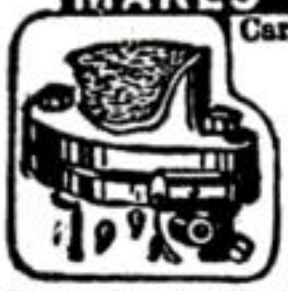
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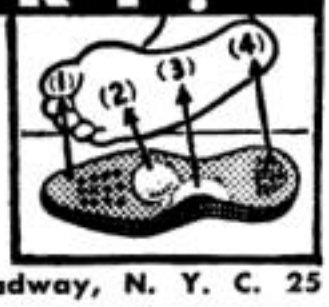
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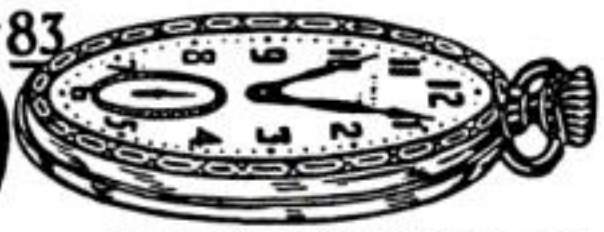


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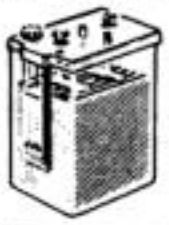
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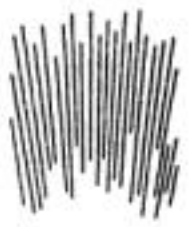
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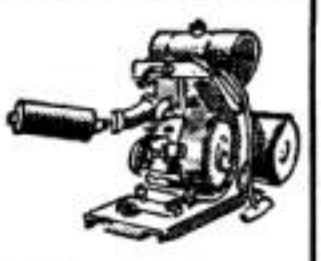


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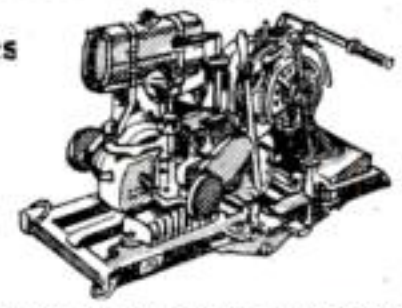
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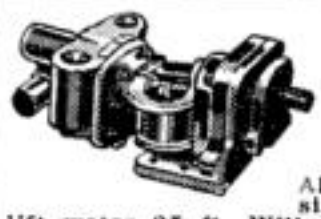
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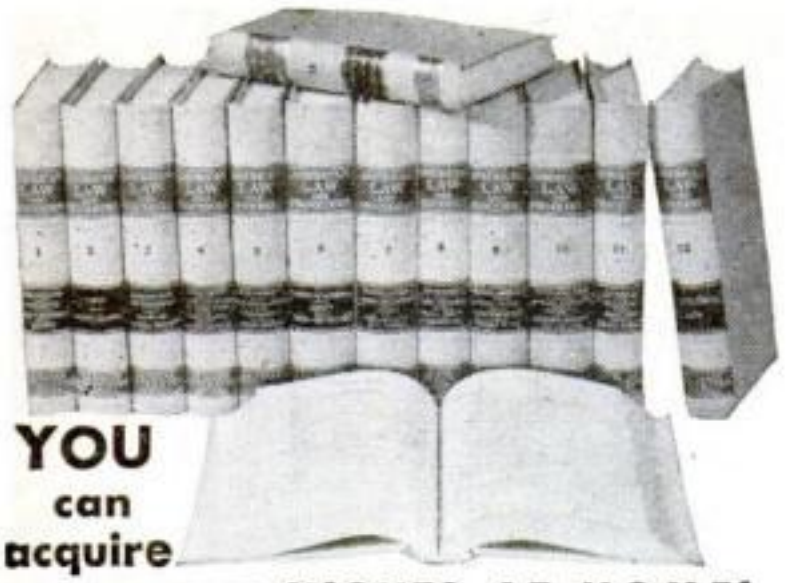
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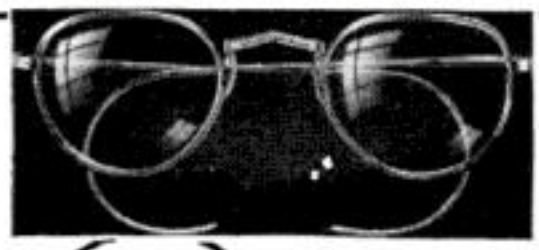
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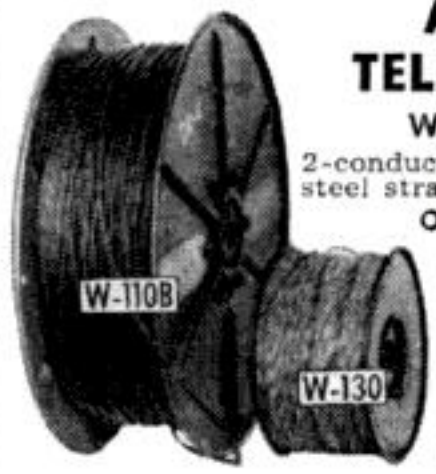


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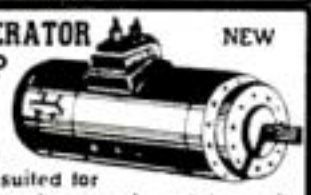
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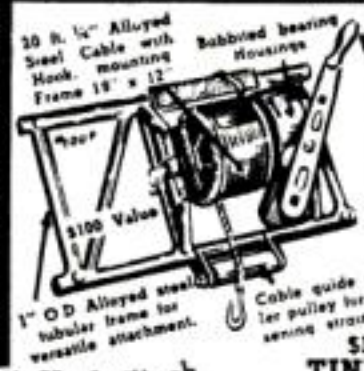
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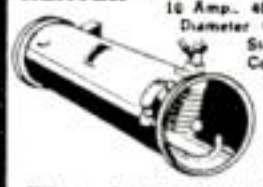
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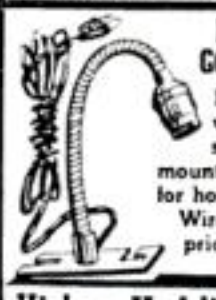
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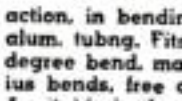


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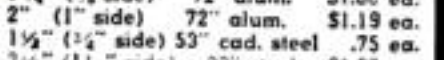
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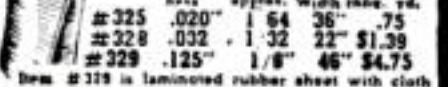
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MAKE tough plastic 1c pound. Makes durable floors, walls, roofs. Build charming home yourself—$150.00 room. Bays Laboratory, Oklahoma City 9.

BIG money is easy! No canvassing or manufacturing. Complete, specific plans, $1.00. Warner, Room 426, 710 N. Plankington, Milwaukee, Wis.

START Your Own Business Making Thermo-Plastic Laundry Labels. Dandy Mail Order. Samples and Instructions $1.00. DeWeese Label Company, Box #373, San Antonio 6, Texas.

BRONZING baby shoes is big business, start your own business for $3.95, all materials furnished. Metalsealed, Box 2095, Wichita, Kansas.

METAL, Onyx, Plastic mountings for bronzed baby shoes wholesale. 20 styles. Hardening solution. Metallurgists, Box 2095, Wichita, Kansas.

CASH For your idea. 280 manufacturers need inventions, patented or unpatented. List free. Invention Bureau, 208-S Clinton, Oak Park, Illinois.

REAL money making opportunity making Interlocking Concrete building blocks. Rex Products Co., Dept. 21, Piqua, Ohio.

GOODYEAR—Has Natural Malaya 75% heavy brushing rubber for molds. Trial half pint 50c. Write full particulars. Goodyear—Lake Geneva, Wis.

ELECTROPLATE on leather, plastics or metal. Instructions $1.50. Four ampere plating unit with instructions $19.95. Eight ampere unit $29.95. Kissel Electric Products, 431 Sherman, Galion, Ohio.

RUBBER: White liquid rubber! America's finest flexible molding rubber! New! Extra heavy viscosity! Quick drying! Ideal for home, classroom, or industry. Only $7.95 per gallon. $2.95 per quart, and $1.00 per half-pint sample. Parcel post prepaid! Plastercraft Supply Company, 3051 St. Clair Ave., Cleveland 14, Ohio.

FREE Folio—400 Money Making deals. Business plans. Schemes. Formulas. Formico Prod., Box 572, Dayton, Ohio.

MANUFACTURE concrete brick in your spare time at home. Hand operated equipment shows profit up to thirty dollars daily. Write for details. Reed Corporation, Three Rivers, Mich.

$3.41 PROFIT per hour interest you? Easy, amazing process velvetizes interiors, signs, novelties, radios, lamps at low cost. Free sample. V-Sparks, 1145 Queen Ann, Los Angeles 6.

CAST Novelties for profit! Genuine Latex molds supplied! Fast sellers! Low cost! Catalog free! Castcraft Studios, 2027-S Fulton Street, Brooklyn 33, N. Y.

METALLIZE Baby Shoes. Excellent profits. New system assures success. Free details. Treasures Forever, 89-B Henry Ave., Lynn, Mass.

MAIL Order Jobber. Protected Franchise. Operate part time from home. Send $3.00 for ten day trial examination. Everything furnished. Tommy Turnipseed, Inc., Box 681, St. Louis, Mo.

MAKE money addressing envelopes. Our instructions reveal how. Glen Glenway, 5713 Euclid, Cleveland 3, Ohio.

PROTECT yourself against mail order losses by reading "Mail Order Pitfalls" first! Only one dollar postpaid! Satisfaction guaranteed. May save you hundreds of dollars. Order your copy today! Better Sales Company, 2139 Clifton Ave., Cincinnati, Ohio.

FREE Folio "Hidden Value in Mail-order". Success Service, Norfolk, N. Y.

MONEY in "Kitty-Kat" Baby shoes complete successful mail plan. No-Co-Ro, Oakland-6-S, California.

NEWEST Christmas Ornaments Brilliant Colors and Designs. Don't Delay. Send $1.00 for Assortment. The Jonacent Company, Belle Harbor, L. I., N. Y.

SENSIBLE, proven successful mail order way. Write American Letter, New Market 1, New Jersey.

START Home plaster novelty business. Amazing course tells how. Literature free. Kemo-Courses, Dept. B, 4862 W. Catalpa, Chicago 30, Ill.

WOULD you pay 3%—first $350 made? Color-illustrated book "505 Odd, Successful Enterprises" free! Some offer occasional "day off." Work home. Expect something odd! Pacific, Oceanside, Calif.

EXTRA dollars or a good living with your typewriter. New, exclusive opportunity. Never before offered. Get details now. Schroder, 221 Bush, Covington 2, Ky.

START Real Estate Business . . . America's Finest Profession Spare Time. Details free. Educational Book Co., 2907 Berwicker Ave., Baltimore 14, Md.

INCOME from local information. No selling. Neher Company, LaVerne, Calif.

FREE Colorful Book "372 Unusual Worldwide Business Adventures"! Photos! Pictures! True; Successful, Australia, Africa, South America, New Zealand, Mexico! Not hokum. Operate some at home. Refreshingly "different" plans. Publishers-B, 1199 Oak, Carlsbad, Calif.

BRONZED Baby shoe mountings and supplies. All metal bronze bookends, picture frames, ashtrays, etc. Onyx ashtrays, desk sets, placques. Hardening solution. 30-amp plating rectifiers with powerstat control. $85.00. Geared motors for agitation $20.00. Lead lined tanks. Write for list. Hollywood Bronz Supply, Dept. S, 1770 N. Vermont, Hollywood 27, Calif.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write; Woodart, Bridgewater, Massachusetts.

WHOLESALE Men's Hygienic Supplies! 48 Samples, $3.00. Acme Sales, Covington 7, Virginia.

SELL $150.00 value for $1.00 and make 95c profit. Terrill, Bogard 1, Mo.

MOLD-Makers. Air-cure latex. Sample and instructions on request; also latex for casting rubber articles in plaster molds. Foam latex. Major Chemical Co., 131 Inman St., Cambridge 39, Mass.

WATCHES, all kinds, new, used; retail $3.65—$345.00; big discounts; show catalogue, get orders. Brookins, B-1975CL, Little Rock, Ark.

MAKE your own products, details free. Pharmacist, 939 Euclid, Detroit (11).

IT'S Easy to Convert Hand Mowers to Power Mowers with Handy-Dandy Lawn Mower Conversion Kits. Installed on any mower in 3 hours. Used with any small gasoline or electric motor. (Lauson Engines and Pennsylvania Mowers in stock. Immediate delivery.) Kits can be purchased with or without engines. Fits 16 to 20 inch mower. Dealers wanted. LeClaire Manufacturing Co., LeClaire, Iowa. Dept. PS.

SALES organization seeks gadgets, books, products suitable mail order. Ansen Associates, 333 E. 43rd St., N. Y. C. 17.

UNPAINTED Figurines. Illustrated list Free. Oman, 642-S, Broadway, St. Paul 1, Minn.

57 MONEY MAKING OPPORTUNITIES

DETECTIVES Earn Big Money. Experience unnecessary. Particulars free. Wagoner, P-125, West 86th, N. Y., N. Y.

SCHOOL Seniors—Sell classmates America's most beautiful Graduation Name Cards. Largest Selection. 40% commission. Outsells all others. Free sample kit. Printcraft, Dept. P, 1425 E. Elm St., Scranton 5, Pa.

$1.00 GETS you 21 money-making popcorn, candy apple formulas. We supply equipment. Concession Supply Company, Dept. B, Station "B", Toledo, Ohio.

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NOVEL Action Jigsaw Toy. M. Winter, 4200 Harford Terrace, Baltimore 14, Md.

METALLIZE baby shoes. Further information 3c stamp. Metal Crafts, Box 125-R5, Tampa 4, Florida.

A $100 a month hobby at home! No soliciting, no mail order, no meeting people. Easy, enjoyable pastime. Details, 25c (Refundable.) Laura Dickson, 1006-PS Elizabeth St., Anderson, S. C.

BE a Notary Public. Largest notary supply house equips you for $16.97, guarantees your appointment by governor. Honor, prestige. You certify legal papers, collect fees. Easy. At home, office, anywhere. You use official seal made with your name. Notaries needed everywhere. Be one. Write Stationers Exchange, Helotes 19, Texas.

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$12.00 PROFIT on 25c investment. Free folder. Suproco, Ogema 7, Wis.

START your own business! Big money manufacturing novelties, plaques, statuary. Free catalog. Write Bing Products, 68-B11B Broad Street, Boston 10, Mass.

WIN contest money. General Contest Magazine gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minn.

WANTED: Men-Women, Interested in earning extra money. Send 25c deposit, (Credited) for details, and gift. Bishop Novelties, Box 877, Milwaukee 1, Wis.

"MOST Everybody Likes Candy." Learn to make in a professional manner. (Our 38th year). Ragsdale Candies, D10, East Orange, New Jersey.

PRIZE Contest Fans Reap Rich Rewards. Enclose 3c stamp. National Contest Bulletin, Box 2685-S, Miami 31, Fla.

SHELLCRAFT! Make beautiful seashell jewelry. Income - or - Hobby! Large illustrated catalog! Supplies, instructions, 10c Postage (Buy Direct From Manufacturer) Pace's, Box 279-S, Bradenton, Florida.

LEARN battery repairing, rebuilding. Battery Bureau, 2227 North 44th St., Milwaukee 8, Wis.

"WHOLESALE Catalog." (Illustrated 10c), Bargains Galore, Stafford, Box 5211PS, Indianapolis 1, Ind.

MONEY Making offers details free. J. G. Schroeder, Box 504-S Anaheim, Calif.

INCREASE Your Earnings: Local Business Opportunities; Mail Order Information; Wholesale Supply Sources Valuable Money-Making Tips; Information. Free details. Rush name. Wilkin Company, Hillsboro 2, Ohio.

EARN $25 distributing 50 boxes of greeting cards. Over 20 different top quality assortments for Xmas, birthday plus deluxe boxed stationery. Also make extra money taking magazine subscriptions. Details free! Cassell Co., 11A, Elm St., Westfield, New Jersey.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle (2), Wisconsin.

WOULD You pay 3%—first $350 made? Color-illustrated book "505 Odd, Successful Enterprises" free. Expect something odd! Pacific, Oceanside, California.

NO selling, operate coin machines, amazing profits, details Free. Parkway Corporation, Dept. 18, 623 W. North Avenue, Baltimore 17, Maryland.

$247.50 making new secret device from pre-fabricated surplus costing $1.50! No experience, machinery. Amazing, indisputable proofs free! Rolls Enterprises, 115 West 16th, N. Y. 11.

58 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Illinois.

GROW Colorful Metallic Gardens. Formula, 50c. Marshall, Box 5356, Chicago, Illinois.

10,000 FORMULAS and Trade Secrets. Free Literature. Stillmans, 555 Kingston Ave., Brooklyn 3, N. Y.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

YOU name it! We'll airmail formula. $1.00. Satisfaction or refund. Brown, 9111A Hoyne, Chicago 20.

59 PLASTICS

NOVEMBER Special. Supply kit including powdered and liquid dyes. Luminous powder and cement. $1.75 Postpaid. Lucite, plexiglas, sheets, rod, tubes, findings. Free catalogue. Craft Plastics, Somerville 2, New Jersey.

PLASTIC—Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 6, Mo.

LUCITE. Plexiglas. Any size sheets. Cost square foot (12" x 12") 1/16" $.96; ⅛" $1.25; 3/16" $1.52; ¼" $1.80; .100—$1.14. Include 10% postage. Almac Plastics, 1150 Broadway, New York 1, N. Y.

PLEXIGLAS—Write for Free Price List. The Unique Glass Shop, 309 Cowardin Ave., Richmond, Virginia.

INTERNAL carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Somerville, New Jersey.

PLASTICS, dyes, findings, shells, craft supplies. Catalog, Fabricating manual, 10c. Lucite sample, 35c. Gem-O-Lite, Box 686G, North Hollywood, Calif.

AMAZING liquid plastic pours cold, hardens in half hour. Clear, colors. Expensive equipment unnecessary. Embed photographs, coins, flowers, seashells. Complete kit only $3.25. Kristalon Plastics, Dept. B-11, Box 29, Wilmette, Ill.

BARGAINS In Plastics. Lucite, Plexiglas, Catalin. Many colors and sizes. Details free. George Plastics, 6938D George Street, Chicago 34, Illinois.

60 CHEMICALS AND APPARATUS

LEARN Chemistry at home, from the House of Winn. Home of Supplies for student Chemists. New idea chemical and apparatus outfits for Home Experimenting. Photographic Scales. Semi-Professional Microscopes and accessories. Send 15c for retail catalogue. Established 1931. John H. Winn, 124B West 23rd Street, New York 11, N. Y.

HANDBOOK for Chemical Experimenters. Hundreds of Experiments; Illustrated, 50c. Experiment Booklet, 15c. Supply Catalog, 5c. Reading Scientific Co., Reading, Penna.

BIG Chemical Value! Only $3.50—24 different chemicals for home experiments—all neatly bottled. Met & Co., 160 Hillside Avenue, Nutley, N. J.

NEW Laboratory supply catalog of Chemicals and Apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company, 1232 N. Paulina St., Chicago 22.

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COMPLETE Supply Catalog, 10c. Pilgrim Chemical, 348 Edith, Salt Lake City 4, Utah.

LABORATORY Supplies at Wholesale prices. Catalogue Chemicals, Apparatus, etc. 15c. Microscopic Stains 20c. Both for 25c. National Scientific Company, 2204 W. North Ave., Chicago 47, Ill.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 10c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, N. Y.

61 HELP WANTED

ALASKA. The Last Frontier offers unlimited opportunities. $1 brings government map and Directory listing firms in Fishing, Construction, Mining, Aviation, Fish & Game rules. Homestead data. Alaska Opportunist, Box 883-S, Hollywood 28, Calif.

RELIABLE man with car wanted at once to call on farmers. Wonderful opportunity. $15 to $20 in a day. No experience or capital required. Permanent. Write today. McNess Company, Dept. 95, Freeport, Illinois.

WORLD Wide Construction Job Listings published monthly for Overseas and USA $1.00 postpaid. Global Reports, P. O. Box 883-PX, Hollywood 28, Calif.

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LONG needed invention. Established company. Every home, factory, store, farm a prospect. Low price, long profit. Exclusive. Fine outfit. No deposit. Local territory. Write 230 R.C. Building, Red Comet, Inc., Littleton, Colorado.

EARN Up To $520 Month part or full time keeping books for small firms. Simplified System. Write Tax-Saver System, Dept. N, Ft. Worth, Texas.

ABRIDGED directory; 160 companies with foreign projects or interests: $1.00 cash (C.O.D. $1.27). Foreign Service Institute, Box 3980, Miami 24, Fla.

62 AGENTS WANTED

GOOD Paying Business Silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures, etc., by late method. No tanks or shop required, outfit furnished. Free Booklet. Gunmetal Co., Ave. G, Decatur, Illinois.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of Automobile Initials and Sign Letters. Free Samples. "Ralco", XL-Roxbury, Boston 19, Mass.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

JOBS Open In Selling! Send name, address for Free copy Opportunity Magazine, listing hundreds of companies who need men now, full or spare time. Experience not essential. Opportunity, 28 E. Jackson, Dept. 15, Chicago 4, Ill.

BIG Money Quickly and Easily taking orders for complete line Personalized Initialed Buckles, Belts, Cap Badges, 2,000 Emblems. Fast repeats. Write today. Hookfast Company, Box 480-PS, Roanoke, Virginia.

MAKE more money selling personal initialed individualized belts, buckles, cap badges, tie holders, name plates, 2,000 emblems to choose. Big profits, whole or part time. Write today—special outfit order. Hookfast Specialties, Box 1425, Dept. 7, Providence, Rhode Island.

FREE sample! Big profit opportunity with amazing Glow-In-The-Dark House Numbers, switch plates, pictures, decals, religious articles. Represent large manufacturer. Madison Mills, 303 Fourth Avenue, New York 10, N. Y.

CHRISTMAS Cards! Jobbers' Prices! Fifty different items from 18c to 38c per box. Gift Wraps, Seals, Christmas Tree Windows, Books, Letterheads, Illustrated Catalog Free! Fantus, 436 North Wells, Chicago.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-118, 7530 Greenwood, Chicago.

NEW exclusive Xmas photo greeting cards, amazing value, big profits, approval samples. Spooner Greetings, 115 Chauncy, Boston, Mass.

AGENTS wanted for our coin operated amusement and slot machines in every town and community. Sell—or start your own route. Big profits! Write for free wholesale catalog and deal. Aerobilt Products Co., Dept. 26, 3767 Druid Station, Baltimore 17, Maryland.

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FREE nylons given if Kendex hosiery runs or snags! World's only women's hosiery sold with a written guarantee that amazes everybody. Mere words could not possibly express the almost unbelievable opportunity you now have to make money. Fantastic and "impossible" earnings now become a reality. Can you imagine a guarantee that replaces hosiery regardless if damage is due to use or abuse and regardless whether it is the fault of the hose or the wearer? Here is sales dynamite that will blast your earnings to the sky! Even if you never sold a thing in your life, three magic words: "Guaranteed Against Everything" will open doors for you—will make women listen and will pour money in your pocket. Kendex stockings are not sold in stores, so you have no competition. Complete line includes beautiful sheer nylons; long wearing, durable service nylons; three different lengths; genuine outsize nylons; latest shades; choice of full fashioned with seams or seamless; lowest priced rayons. Also separate complete line of men's hosiery including nylon, lisle, rayon, cotton, mixtures, etc.; plain and fancy; long and short. Thousands of pairs shipped daily. No money or experience needed. Nothing to invest or risk. No samples to buy. Nothing to pay, now or later! Simply write orders. We deliver and collect. Liberal advance cash plus huge cash bonus. Write orders spare or full time; exclusively or as a side line. Become a manager and appoint others to sell for you with steady income on their sales! Complete money-making outfit, including sales books in colors, samples cut from actual hose, instructions, order blanks, etc. furnished free and prepaid. Rush name and address on postcard and start making money next week. Kendex Co., Babylon 186, N. Y.

SCHOOL Seniors—Earn 40% commission selling classmates America's most beautiful Graduation Name Cards. Largest Selection. Outsells all others. Free Sample Kit. Printcraft, Dept. P, 1425 E. Elm St., Scranton 5, Pa.

SELL new, used clothing from home, auto, store. Wholesale catalog Free. Calumet Sales, 4719 Kennedy Ave., East Chicago, Indiana.

GUARANTEED product in protected territory, if you are now selling or intend to sell house-to-house. For full 1 Qt. Sample amazing High Shine Windsor No Rubbing Wax, send only 25c covering handling and postage. (Sells for $1.25). Windsor Wax Co., Inc., Dept. P.S.-2, Hoboken, N. J.

FREE water and our concentrates make flavors, lotions, shampoos, 72 products. Labels, bottles furnished. Qualco, F-20030 Russell, Detroit.

MAKE one thousand dollars or better monthly selling Safety Clamps. Will stop shimmey. Positive lock or tie rods that have caused thousands of deaths. Positively a must for intelligent motorists. No consumer resistance. Agents make $3.00 per dozen. Distributors wanted. Cheapest insurance against death in existence. Free literature. Lox-It Manufacturing Co., Clarksdale, Miss. Sample 95 cents.

STRANGE "Dry" Window Cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 127, Akron, Ohio.

BIG Bargains for big profits. Over 100 sensational wholesale values. Men's used suits $2.00, pants 35c, topcoats $1.25, overcoats $2.00, shoes 20c. Experience unnecessary. Free catalog. Superior, 1250-B Jefferson, Chicago 7.

AGGRESSIVE agents wanted to demonstrate guaranteed Copper-Cote Ironing Pad and Cover sets. Endorsed by housewives everywhere. Sure-fire sales plan helps you get started. Generous commissions. Protected territories for producers. Real deal for live wires. The Sheldon Company, Box 1347, Milwaukee, Wisconsin.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New Foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

POCKET Pal: Replaces Pocket Knives. New, Safe, Beautiful. Always razor sharp. 50c seller. 321% profit. $15.00 or more daily. Agents, Salesmen, Distributors. Sample 10c. Nelson Mfg. Co., 222 W. Kellogg, St. Paul 2, Minn.

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LOOK here! Wanted—Men to start in business on our capital. Sell some 200 farm-home Products. Thousands our Dealers now make quick sales, big profits. For particulars write Rawleigh's, Dept. K-192-PSC, Freeport, Ill.

NEVER before new mechanical way to wash your car professionally. Easy to use. Save time! Money! Guaranteed. Write for details. Sample $4.95 prepaid. Melaire Distributing Co., 420 Lexington Ave., N. Y. 17.

REPRESENTATIVES, Fast Moving Household Product. 1 Pound sample and information. 50c. Brennan's Product Company, 10015 Grevillea, Inglewood, Calif.

BIG Money—Fast. Sell Quality Plastic Tablecloth (from $4 doz.), Aprons, Curtains, etc. Factory Prices! Free Samples! Durever, 314F Albany Ave., Bklyn 13, N. Y.

MAKE 100% profit selling name imprinted Christmas cards and $1.00 assortments. Also personalized napkins and stationery. Request samples. Dunbar, Sanford 2, Florida.

MAKE big weekly commissions selling nationally advertised aluminumware, silverware, pressure cookers, canners and gift items. No investment required. Simply take orders, collect commissions, we do the rest. Complete sales kit free. Write Ury Co., Dept. 39C, 222 4th Ave., New York 3.

$5.00 CASH advance commission every sale 38-piece "Lady Ann" silverware. Guaranteed quality, value bring sales galore. Also varied line of other silverware and housewares. Write for sure-fire Sales Outfit. Dexter Silver Co., Dept. PS-11, 303 Fifth Ave., New York 16.

$1 STARTS you in business. Sell lined ties. 100% wool interlining. Costs you only $7 per dozen, you make $5.00 dozen. Send $1.00 for special introductory offer two ties. Catalog complete line Free. Philip's Neckwear, 20 West 22nd St., Dept. P28, New York 10.

SELL ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. "7x11" cost 6c—Sells 35c—Make money. 15 samples Ultra-blue signs "7x11"—$1.00 postpaid. L. Lowy, 8 West Broadway, Dept. 430, New York City 7.

EARN Big Money Year 'round. Be a one-person-department-store. Take orders for shirts, ties, hosiery, lingerie, Household linens, etc. For information Corporative Merchandisers, Dept. PS-8, 110 West 34th Street, N.Y.C. 1.

AGENTS Wanted for our Slot Machines and coin operated amusement games in every town and community. Sell to clubs and homes, or start a route. Webb Distributing Co., Dept. P40, 6 So. Kedzie Ave., Chicago 12, Ill.

SCHOOL Seniors!!! Your postal will bring our wonder, Kwick-Sell Cardalog of popular Graduation Name Cards. Biggest profits!!! Only firm giving free souvenir chest and Card Case. Don't miss out! Hurry that postal!!! Craftcards, Box 235 (M), Pittsburgh 30, Pennsylvania.

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INFORMATION — Wholesale supply sources, Moneymaking plans, Increase your income. Write Reynard Station, Smithfield 3, Ohio.

70c PROFIT On Every Dollar with new sales plan. Circular tells how. Alliance Chemical, Alliance, Nebr.

SPECTACULAR Guarantees, popular prices, make selling easy. Biggest steady repeat profits selling Colt's famous men's, Women's Guaranteed shoes, hosiery. Experience unnecessary. Free selling outfit. Colt Shoes, 601-K11 Atlantic, Boston 10, Mass.

MAKE 50% on $15 Business Service Folder "S"—$1. Dasco, Moosup, Conn.

PLASTICS. Knives, Coasters, Other Advertising Specialties. $108.00 actually earned in day. Kit $1.00 Refundable. E. Howlet, Huntington, N. Y.

SILVER Plating Liquid (NuSilver). Apply with cloth. Durable, guaranteed, genuine, silver finish. Renews silverplated ware, articles, pieces. Silverplates brass, copper. NuProcess Products, Aurora, Ill.

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MAKE Sensational Profits! New, sell-on-sight Plastic Line: Tablecloths, Aprons; many other splendid fast-selling items, novelties. Postal brings free details, special deals. Hurry! Royalty, Box L-748, Passaic, N. J.

BUY thousands of nationally advertised products direct from manufacturers. Write for "Buy Direct and Save." Consumers Ass'n., 287-B Lebanon Ave., Mt. Lebanon, Pa.

MAKE 60%-100% profit as sales representative for all-metal interlocking weather strip sets. Prospects everywhere. Experience unnecessary. Write E-Z-ON- 29, Box 1061, Federal Bldg., Chicago 90.

POSITIVELY New, 100% Profit. Heavy repeat sales. Fast selling, two sided, reversible necktles. Free details. Farrell Company, Dept. 20, 1377 Galbraith, Cincinnati 31, Ohio.

SELL!! Balloons, Combs, Specialty Merchandise. Carleton House Distributors, Texas City, Texas.

WOULD you pay 3%—first $350 made? Color-illustrated book "505 Odd Successful Enterprises" free! Proven! Work at home, office. Expect something odd! Pacific, Oceanside, California.

YOUR Own Business, $100 Weekly. Fast selling plastic furniture covers. Floral table covers, aprons, etc. 100% profit. Free Sample. Carwell, 330-GG South Wells, Chicago.

SELL famous $3 "Fire-Killer" extinguisher with bracket, wholesale or direct; exclusive territory. Demonstrating sample $2; refilled free. "Fire-Killer," Syracuse 1, New York.

QUALITY Merchandise at new low prices. Plastic tablecloths, aprons, garment bags, utility covers. Free illustrated Price list C811. Acclaim Products, 25 Hillside Ave., New York 34, N. Y.

BIG Profits! Sell Deluxe Three Piece Set. Ball Pen, Hooded Pen, Mechanical Pencil. Gold Plated Caps. Sample $1.50. Write Sampa, 1120 Brighton Beach Ave., Brooklyn 24, New York.

63 HIGHGRADE SALESMEN

START your own business on our capital. Always your own boss. Hundreds average $6,000 to $25,000 annual Sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh's, Dept. KU-PSC, Freeport, Ill.

MAKE $15.00 to $25.00 per day. Joe Louis' and Marva Louis' (his wife) toilet articles, cosmetics and other products for men and women are sensational. White people like them; colored people buy on sight. Perfumes, powders, pomades, creams, brown creams, flavors, remedies, and many other fast sellers are our features. $3.95 buys $10.03 (23 items) retail deal—send $1.00, pay postman balance. Be first in your community to offer this new line and you will be happy. Joe Louis Products Company, 6 E. Garfield Blvd., Dept. PS-11, Chicago 15, Illinois.

DROP Shipments. Bar-B-Cue picnic sets, Mowers, Engines, Motors. Farmco, M2011, Excelsior Springs, Mo.

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MAKE $500.00 A Week!! Be first with "Neo-Fluorescent" Revolutionary Invention! New Type Fluorescent Sign Replacing Neon. Fantastic Virgin Market with Dealers, Mfgs, Distrib, nets Fabulous Profits. Free Sample offer. Rose Co., 539-XX So. Franklin, Chicago.

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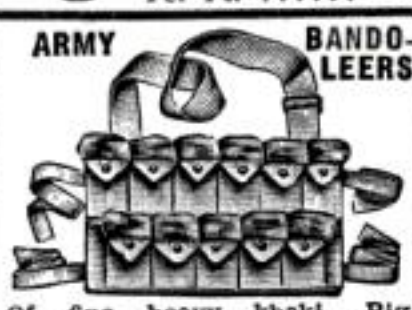
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Brand new gov't. surplus. Army-Navy model. Single jewel mounted needle. Silver colored dial. A splendid value. Shp. wgt. 1 lb.
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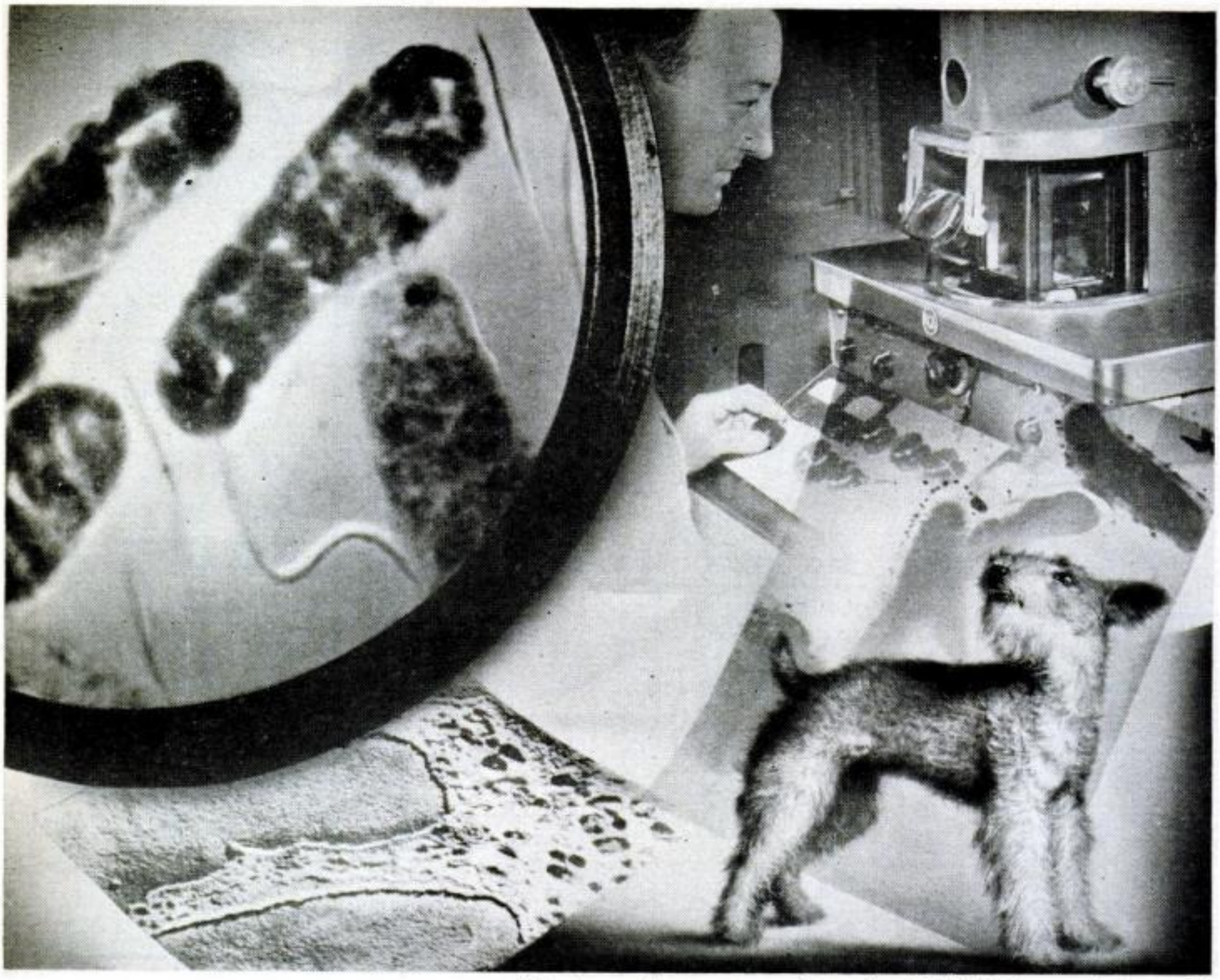
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Electron microscope, perfected at RCA Laboratories, reveals hitherto hidden facts about the structure of bacteria.

Bacteria bigger than a Terrier

Once scientists, exploring the invisible, worked relatively "blind." Few microscopes magnified more than 1500 diameters. Many bacteria, and most viruses, remained invisible.

Then RCA scientists opened new windows into a hidden world —with the first commercially practical electron microscope. In the laboratory it has reached magnifications of 200,000 diameters and over. 100,000 is commonplace . . .

To understand such figures, picture this: A man magnified 200,000 times could lie with his head in Washington, D. C., and his feet in New York . . . A hair similarly magnified would appear as large as the Washington monument.

Scientists see both bacteria, and viruses — and have even photographed a molecule! Specialists in other fields—such as industry, mining, agriculture, forestry—have learned unsuspected truths about natural resources.

Development of the electron microscope as a practical tool of science and industry is another example of RCA research at work. This leadership is part of all instruments bearing the names RCA, and RCA Victor.

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What This World Needs Is a Good, Cheap Radio

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A radio set could help win the peace. Basic receivers so cheap they could be handed around like books. So simple they could be assembled with primitive materials. So easy to operate that an intelligent if illiterate peasant could twist them to get his own language.

We live in a country where the day-old newspaper is the cheapest wrapping for garbage. It is hard for us to realize that other millions get only such information as their rulers give them. That, in fact, four-fifths of the peoples of the world have no access at all to what is going on.

In our one-fifth of the world, radio development has naturally been toward better sets, beautifully made, for high-quality reception. But industrial science and engineering can work both ways. And in the forefront of radio are the amateurs and experimenters. The collective know-how could soon develop the *minimum* sets that would provide the *maximum* of people with communications.

Basic radios, receiving national and world programs, would let a would-be citizen of the world anywhere know what was going on in his world—and in his country.

In the present conflict of meanings, freedom to listen is as vital as freedom to speak. It might even be cheaper, if we have something to say, to pass out hearing aids than to shoot off the little radios in shells and bombs.

Percy Githerings

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He's learning fast— he's got P.A.*

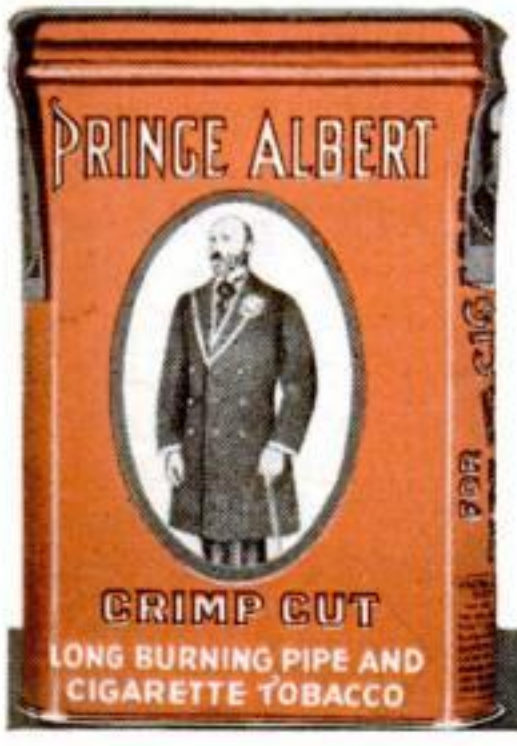


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Locks In the Freshness and Flavor!



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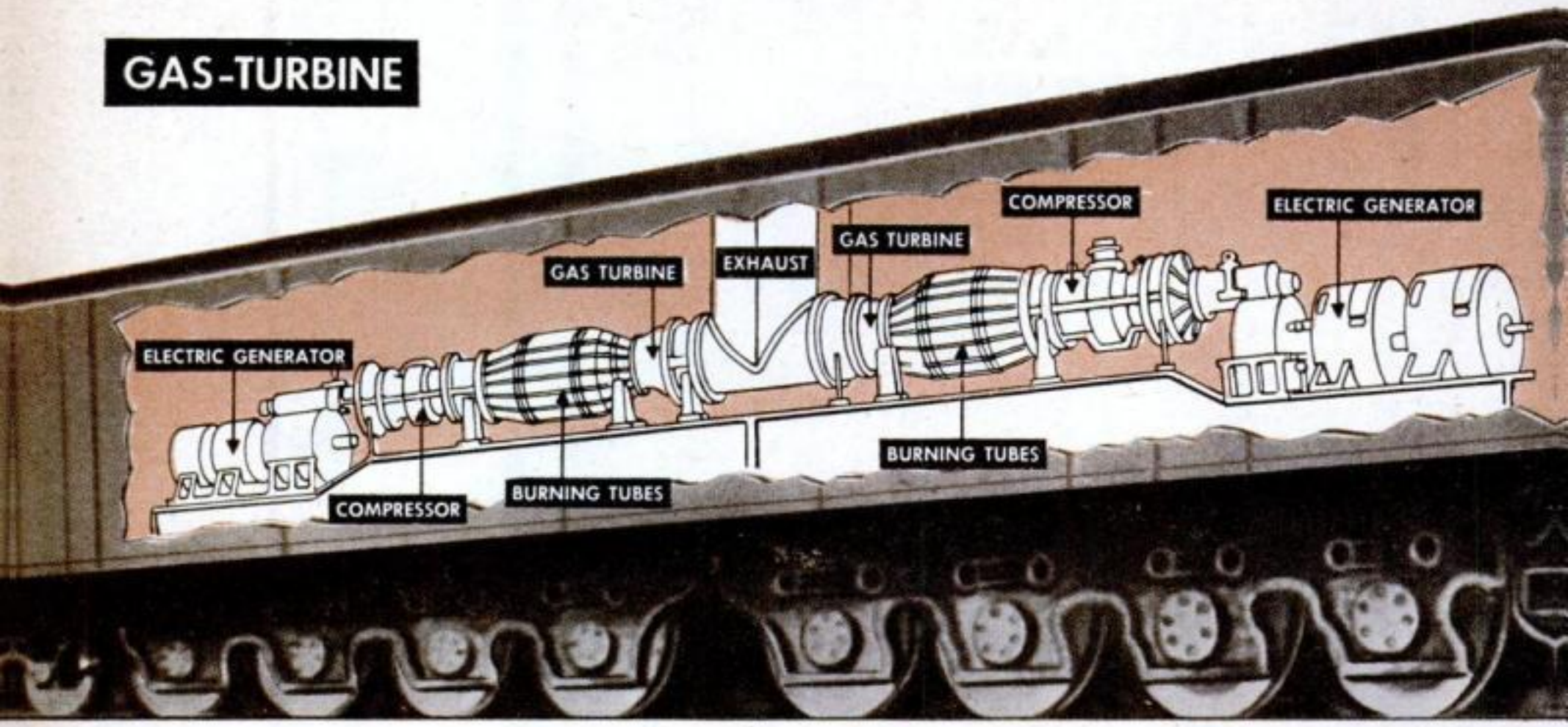
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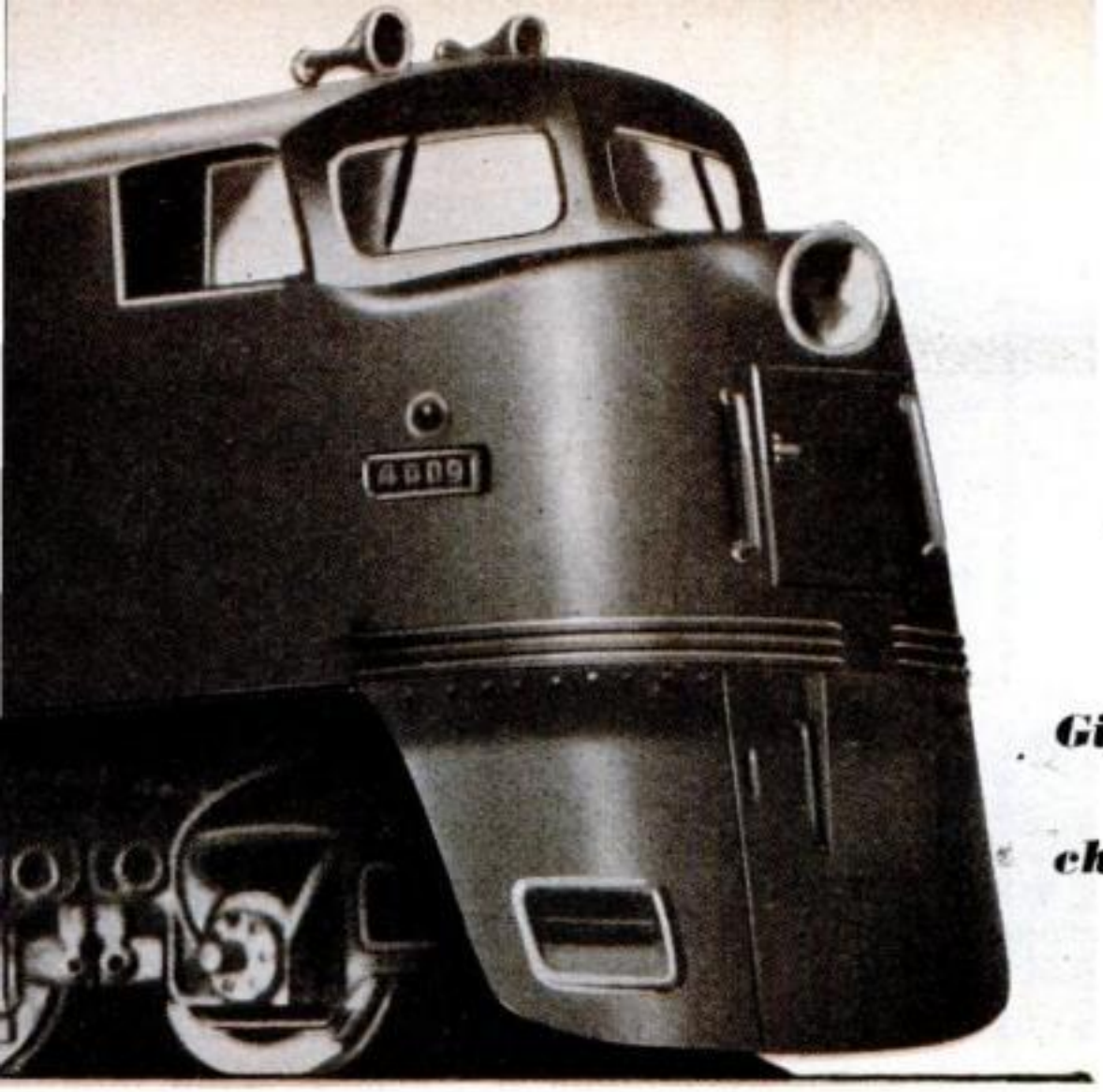
Stacking Up with the Best . . . When the huge, oval-shaped section above swung gently into place, it topped off the world's largest ocean-going smokestack. The slim, streamlined funnel is 53 feet long and 46 feet high. It is shown being installed on the *Caronia*, new 34,000-ton luxury liner now nearing completion at Clydebank, Scotland, for the Cunard White Star Line. The stack, weighing 125 tons, will be the *Caronia's* only funnel and will house machinery as well as exhaust stacks for her oil-fired steam turbines. Largest passenger ship now being built, the *Caronia* has an over-all length of 714 feet and a 91-foot beam.

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The New Iron Horses

A single locomotive, as shown at top of page, could house four 2,000-hp. gas-turbine units.



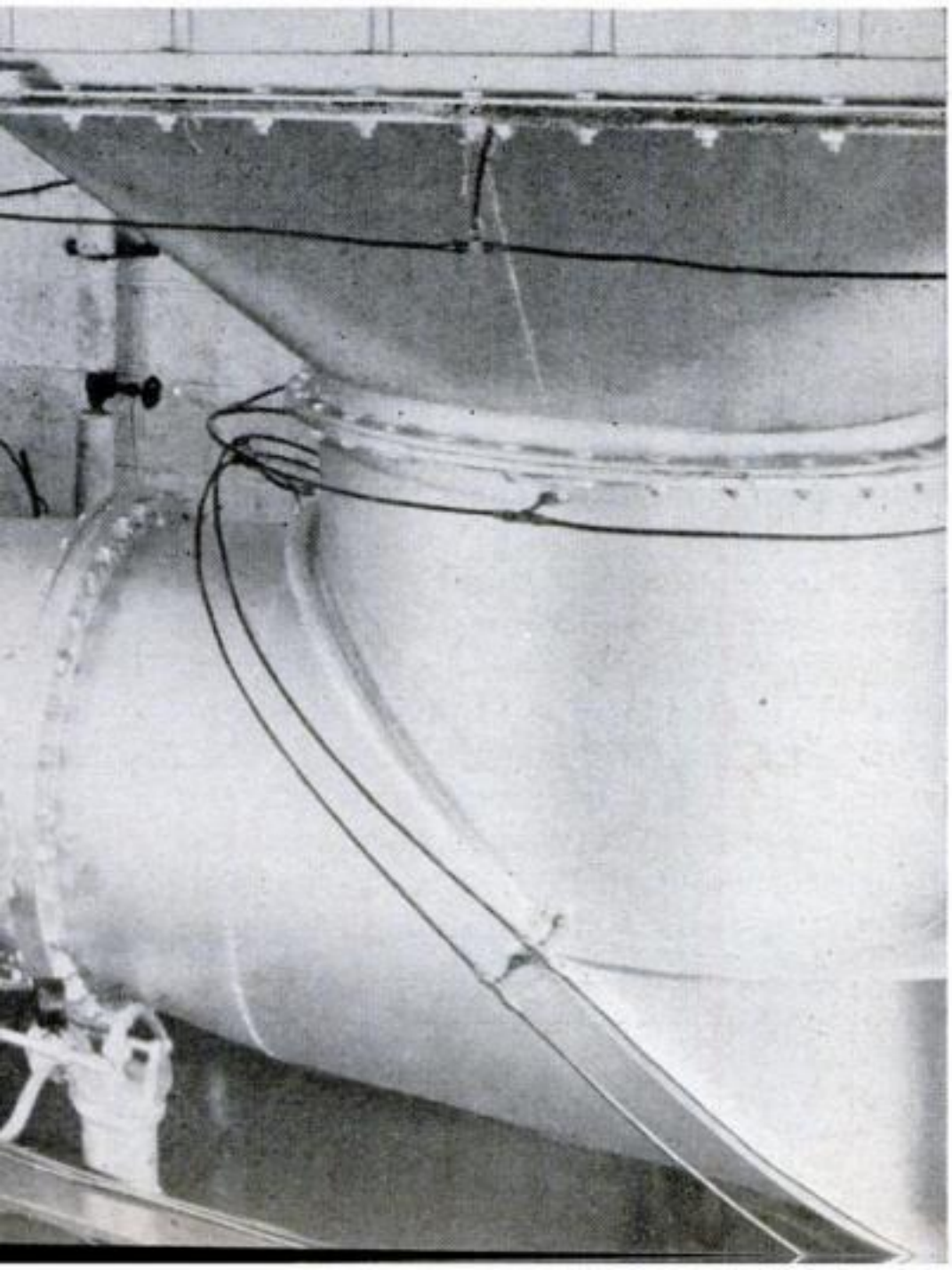


Cover drawing by Ray Pioch

Gigantic gas turbines and secret free-piston engine challenge 100-year rule of coal and steam locomotives.

Don't Drink Water

The Westinghouse turbine is shown below.



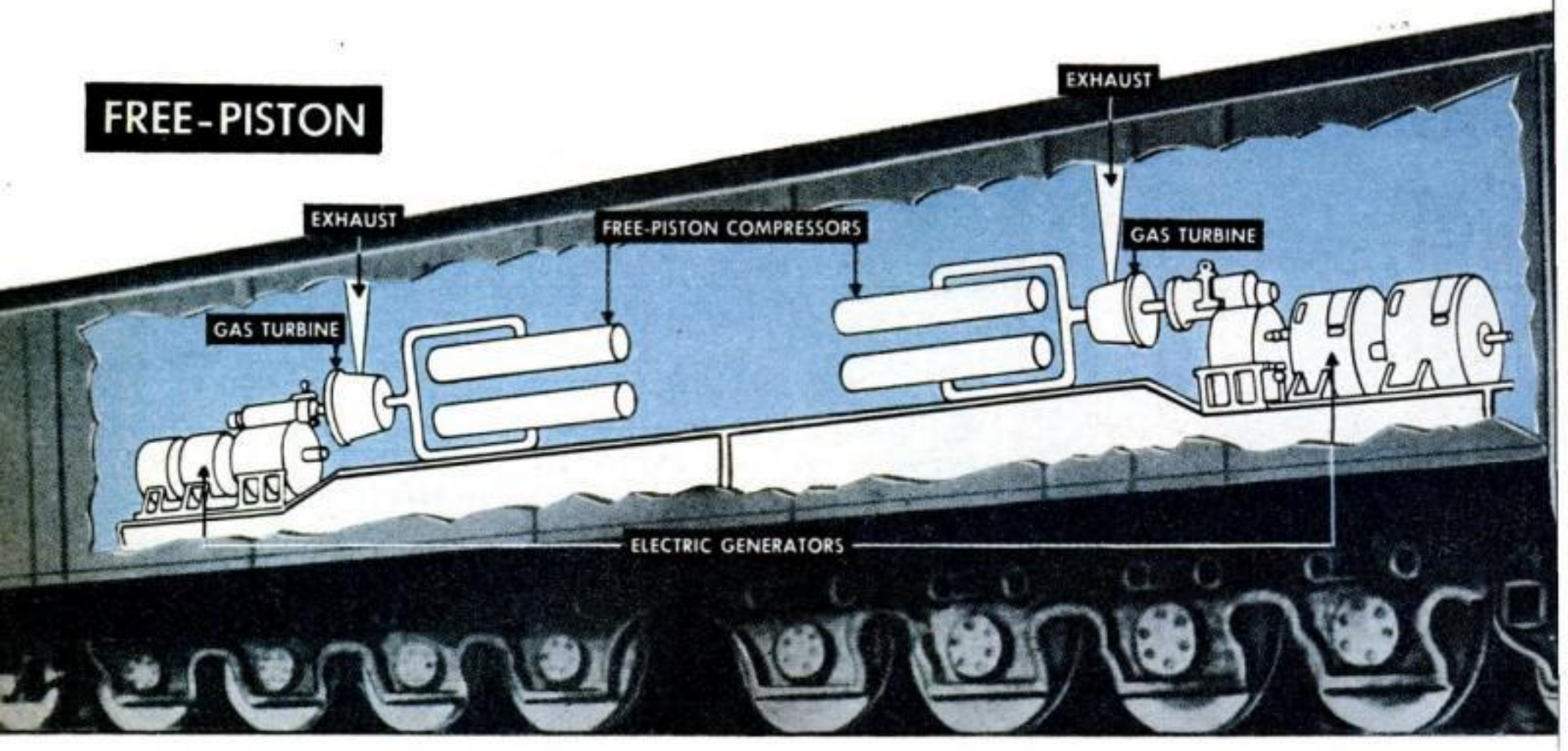
By George H. Waltz, Jr.

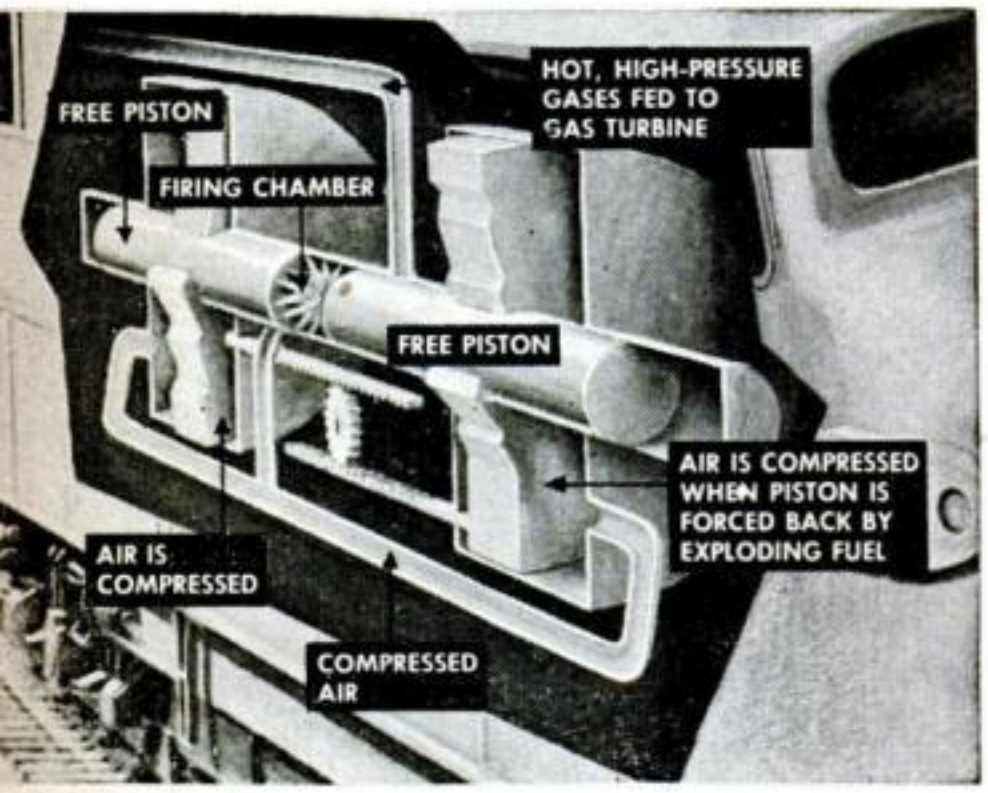
THREE brand-new kinds of mechanical steeds are being groomed for the never-ending race of the iron horses.

For more than a hundred years, steam and coal ruled supreme on America's rails. Then came the all-electric and the Diesel-electric engines. They brought higher operating efficiency, smoother starting, and greater flexibility. In 1946 three-fourths of the locomotives made by one of the country's leading producers were steam engines and only a fourth were Diesels. But this year only 8 percent of this same company's production will be steam—the other 92 percent will be Diesel. It looks as if the spume of smoke and steam that has marked the railroad for a century will pass away from the American scene. So may the water tank. The newest iron horses don't drink water.

And, despite its apparent triumph, the Diesel is by no means a sure winner. Three revolutionary types of locomotives are now entering the race: a gas-turbine

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Free-piston locomotive. Although secrecy surrounds the details of this newest entry in the race of the iron horses, experts picture it as a variation of the basic gas-turbine locomotive. To obtain a higher operating efficiency, a mechanical compressor and gas producer is substituted for the turbinelike compressor and combustion tubes of the conventional gas turbine. Opposed pistons, which are "free" in that they are not connected to a drive shaft, travel back and forth in a single cylinder. A central firing chamber keeps the pistons sliding in and out. As the pistons move back, they compress the air behind them. This compressed air is then fed to the firing chamber and mixed with the gases of combustion from the exploding fuel oil. The superheated, high-pressure mixture of gases is used, finally, to turn the propellerlike blades of a gas turbine.

locomotive, a free-piston locomotive, and a coal-burning gas-turbine locomotive. They may well challenge the Diesel's lead. All are well along in their experimental stages. Test models of at least two of them should be rolling along the rails late next year.

The prime movers in all three of these new locomotives are basically gas turbines. They are products of lessons learned while perfecting the turbojet engine for aviation use.

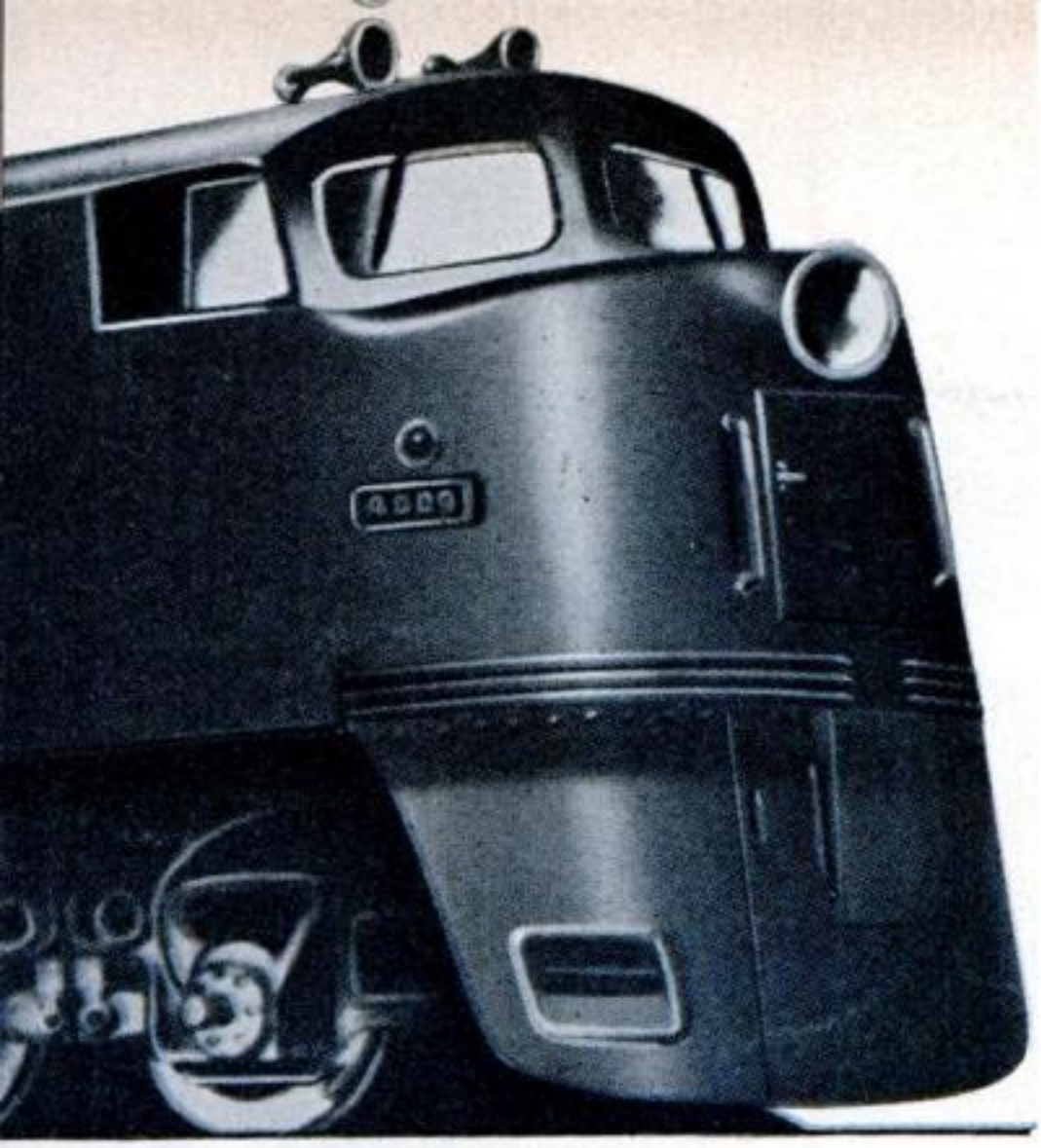
The gas turbine itself is not new. Its theory was fairly well developed 60 years ago. But it was the turbojet work during World War II that finally brought forth materials that could withstand the extremely high temperatures, ranging above 1,300° F., that are needed to make a gas turbine operate efficiently.

Two of the pioneers in designing engines for jet planes—Westinghouse and General Electric—are now fathering the gas turbine for railroad use. Both have full-size test models of locomotive gas-turbine power plants in operation, and both have completed plans for actual gas-turbine locomotives.

In a locomotive, the simplest kind of gas turbine can be used. Fundamentally, this is nothing more than a hot-air engine burning fuel oil. It has only three major parts—a turbinelike air compressor, a series of combustion chambers or tubes in which the fuel oil is burned to produce hot gases, and the gas turbine itself (PS, Sept. '48, p. 138).

Both the turbine and the air compressor are mounted on the same shaft. Hence, in actual operation the turbine drives the com-

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pressor. Air from the atmosphere is sucked into one end, compressed and mixed with fuel oil, which then is burned to heat the air. Finally, the combined hot, high-pressure gases are exhausted through the propellerlike blades of the turbine. This is the power wheel. A generator geared to the turbine shaft produces electricity to turn the locomotive's driving motors.

A locomotive gas turbine of this type has been on laboratory test since 1946 at the Westinghouse plant in South Philadelphia. Though capable of putting out 2,000 hp., it is less than 27 ft. long and weighs less than 20 tons. When producing its peak power, this Westinghouse turbine whirls at a speed of 9,200 r.p.m. (Gears step down the speed of the turbine shaft to the 1,200 r.p.m. needed to drive the direct-current generator.)

Twenty-two rows of blades in the compressor, whose tips spin at 502 m.p.h., suck in 55 tons of air every hour and raise its pressure to five times that of the outside air. From the compressor, the air is fed into 12 slim combustion tubes clustered like the cartridge chambers of a revolver around the spinning central shaft that couples the turbine to the compressor. Here it is mixed with the injected fuel and ignited. The fiery mixture of heated compressed air and hot gases blows through the turbine with terrific force.

To withstand the great heat and the wear and tear, the blades of the gas turbine are made of an alloy of cobalt, chromium, and tungsten. Because this material is much too hard to machine and too brittle to forge, the blades were cast by the revived "lost wax" method—a technique first tried by Benvenuto Cellini in the 16th Century (PS, Sept. '46, p. 124).

Although the efficiency of a gas turbine of this type (about 25 percent) is less than that of a Diesel (about 37 percent), the gas turbine can burn a much cheaper grade of oil. This makes its over-all fuel cost per mile competitive with that of the Diesel. Beyond efficiency and fuel cost, however, the gas turbine has other qualities that make it particularly well suited to railroad use.

Its relatively small size allows a large amount of potential horsepower to be stabled in a small space. This makes possible the construction of locomotives that weigh only two-thirds as much and are only one-half as long as Diesel locomotives of the same power. Two of the Westinghouse units, producing a combined 4,000 hp., can be housed side by side in a locomotive no larger than a 2,000-hp. Diesel. It is this type of two-unit gas-turbine locomotive that Westinghouse has under construction. Its weight per horsepower, one of the principal measuring sticks used in gauging mobile power plants, will be considerably less than that of any other self-sufficient locomotive.

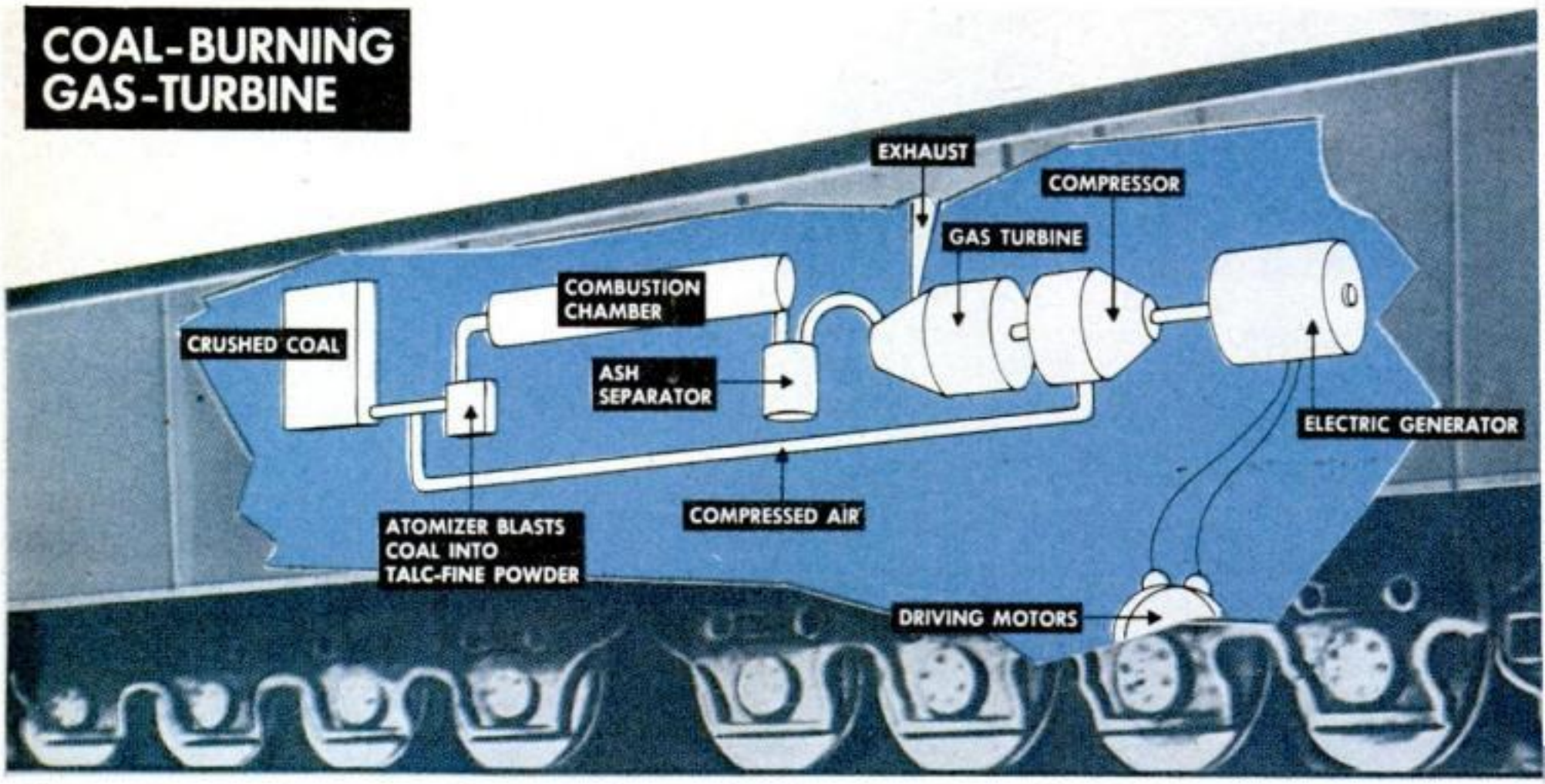
What's more, argue the advocates of the gas turbine, it requires only a minimum of lubrication (a major consideration in the operation of a Diesel), uses no water, and presents no ash problem. It has no reciprocating parts and is easy to maintain and service.

Free-Piston Engine Kept Secret

Darkest horse in the race of the new iron horses is the "free-piston" locomotive. This entry is being groomed behind locked laboratory doors. Although Gwilym A. Price, Westinghouse president, announced more than six months ago that his company was cooperating with another large Eastern manufacturer in the construction of such a locomotive, the engineers of both companies are reluctant to talk about the actual details.

It is known, however, that the development work is progressing, and a poll of turbine and combustion experts reveals a general picture of how a free-piston locomotive could operate. The major difference between it and a conventional gas turbine is that it has a new kind of combined mechani-

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This gas-turbine locomotive burns finely powdered coal to produce hot, high-pressure gases.

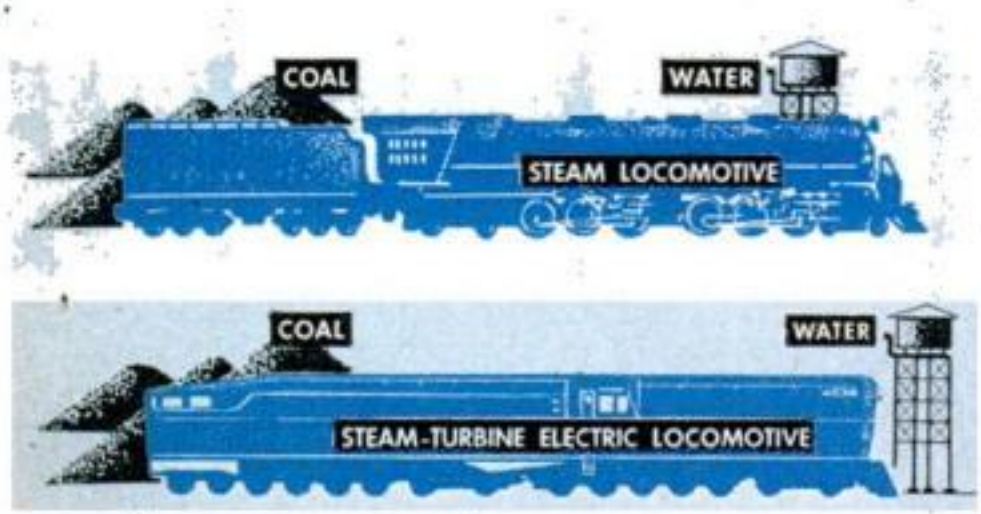
cal compressor and gas producer in place of the tandem compressor and combustion tubes.

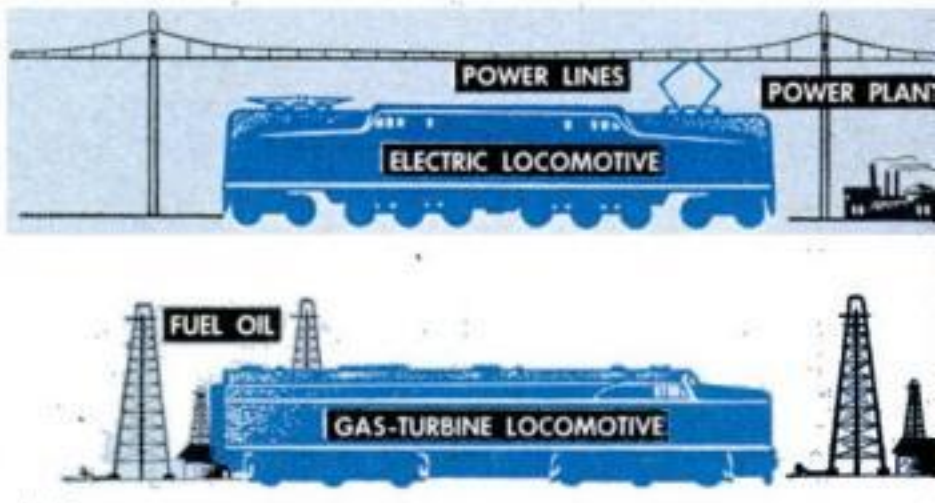
In this free-piston power plant, opposed pistons travel back and forth in a cylinder. Unlike the pistons in an automobile engine, they are not connected to a drive shaft. Their function is not to drive something but to supply the hot gases for a gas turbine. A firing chamber in the center keeps the pistons flying back and forth. Their action compresses the air behind them, causes fuel oil to burn in this compressed air as it is fed into the combustion chamber, and releases a mixture of the hot gases at each stroke. These hot gases then are fed to a gas turbine, which in turn drives an electric generator to provide power for the locomotive's driving motors.

The primary advantage of this free-piston type of mechanical compressor over the conventional compressor is said to be its greater efficiency. The free-piston gas-turbine is expected to be just about as efficient as the Diesel. In fact, the firing chamber and its two opposed pistons operate on the two-cycle Diesel principle, but instead of producing driving power on a shaft they produce hot, high-pressure gases.

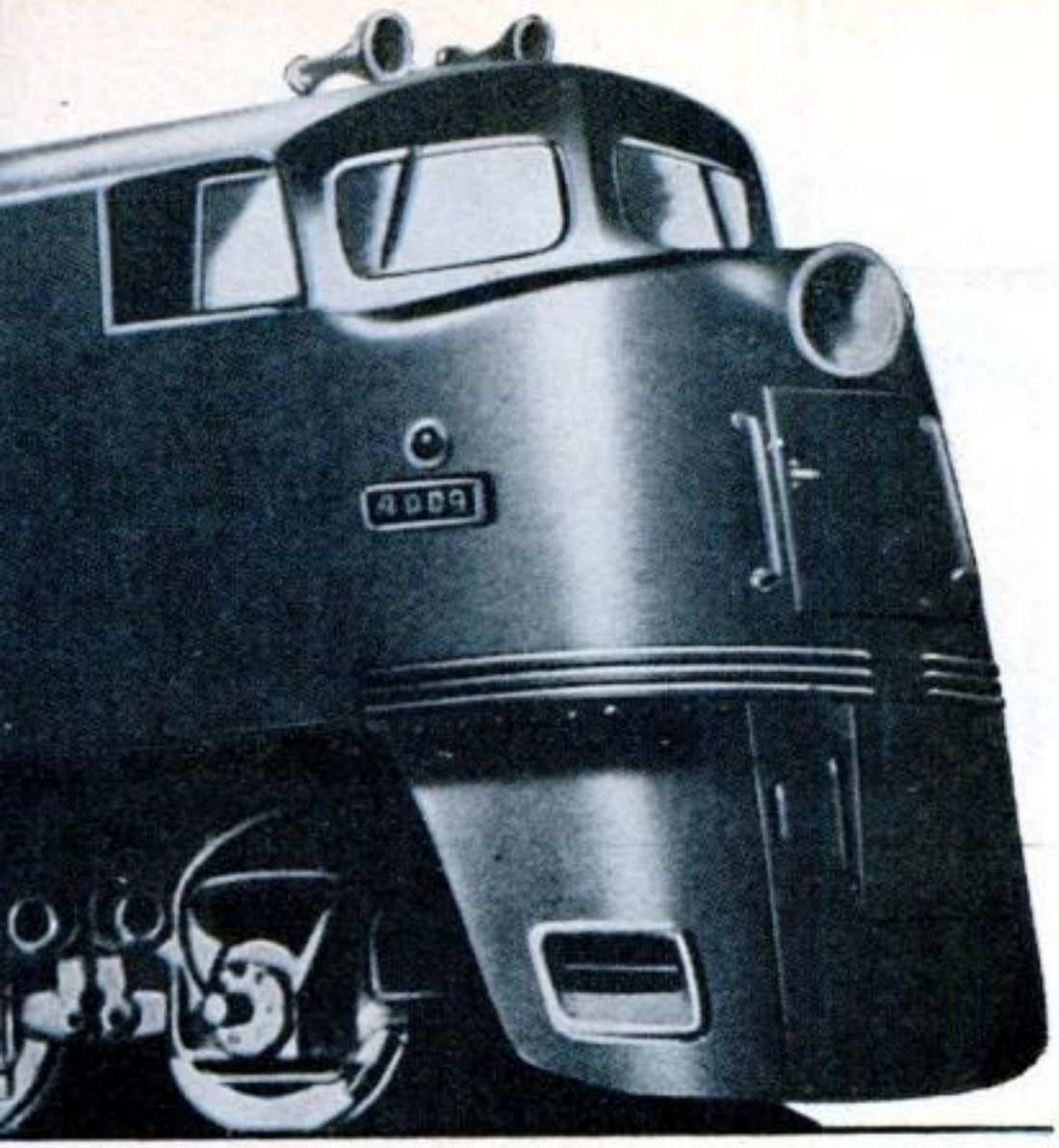
Despite the wide interest in oil-burning gas turbines, however, oil has by no means completely replaced coal in the thinking of the builders of the super-locomotives of tomorrow. Already on the rails are four coal-

A WHO'S WHO OF RAILROAD LOCOMOTIVES





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Gas spins turbine driving electric generator.

burning steam-turbine locomotives. Three, owned and operated by the Chesapeake and Ohio Railway, have their steam turbines geared to electric generators to provide power for the motors that turn their driving wheels. The fourth, pulling crack trains for the Pennsylvania Railroad, has its turbine geared directly to the driving wheels.

These locomotives are seeing continuous service and show increased efficiency over the regular coal-burning steam locomotive. With more efficient steam-generating boilers, now being worked on by Babcock and Wilcox, steam-turbine locomotives may more nearly match the relatively high efficiencies claimed by the Diesel engine and the gas turbine.

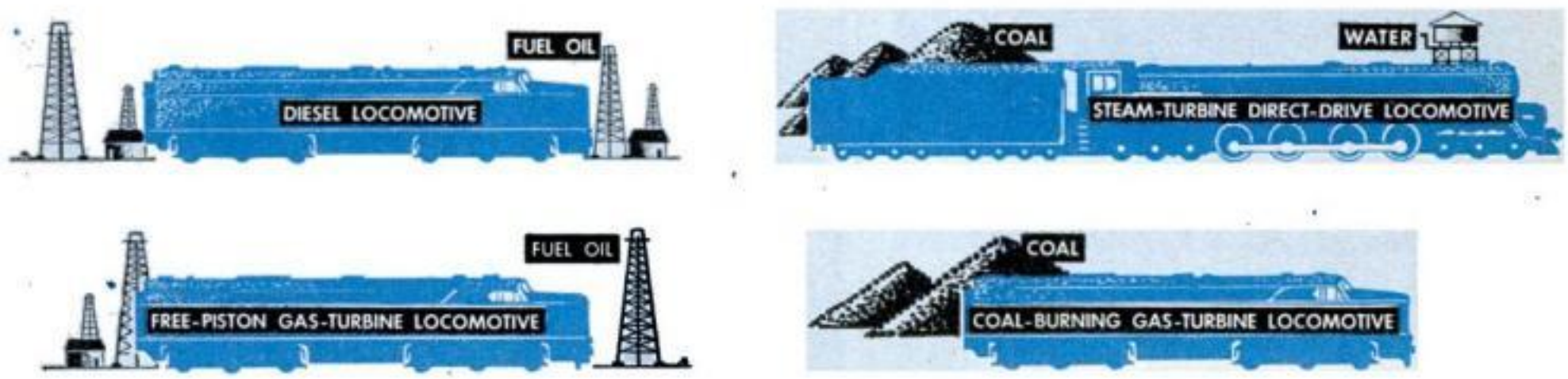
The favorite entry of the coal enthusiasts, however, is the coal-burning gas-turbine locomotive. At the moment, at least half a dozen organizations are experimenting with the possibility of using coal as the source of the gases needed to drive a gas turbine. If they succeed and are able to produce a locomotive that can match or outmatch the efficiency of the Diesel—and many experts think that they can—coal once more will rule the rails. Such a locomotive would combine the advantages of the gas turbine with the low cost and the large resources of soft coal.

Two big problems have, up until now, stood in the way of a practical coal-burning gas turbine. One is how to grind the coal to talcum-powder fineness, so that it can be readily and easily gasified. The other is how to remove the ash and foreign matter from the resulting gases, so that they will not pit and eventually destroy the blades of the gas turbine.

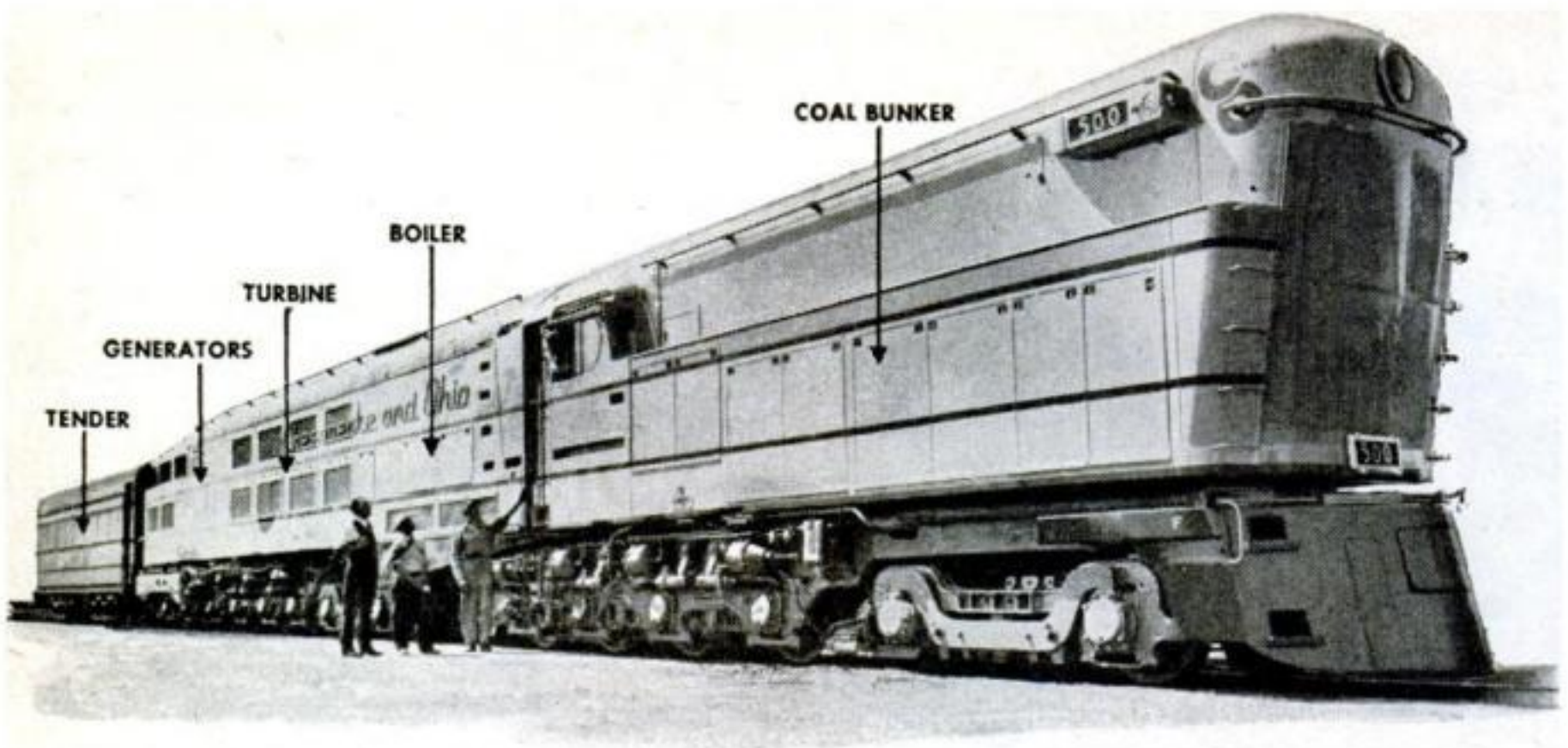
Among those who feel that these two major problems have been licked is John I. Yellot, director of the Locomotive Development Committee of Bituminous Coal Research, Inc. Supported by nine major railroads and four large coal producers who have sponsored a $2,800,000 research program, his committee has been attempting to work the bugs out of the coal-turbine theory.

A gas turbine once destined for Russia under lend-lease is now being altered at the committee's Dunkirk, N. Y., laboratory to use powdered coal instead of oil as fuel. In Yellot's version of the coal turbine, crushed coal will be "fluidized" by conveying it, under high air pressure, to a "coal atomizer." Here, as the coal passes through a small nozzle the rapid expansion of the air trapped inside it will literally blow it apart to form a powder as fine as talc. The finely

SHOWING WHERE THEY GET THEIR POWER



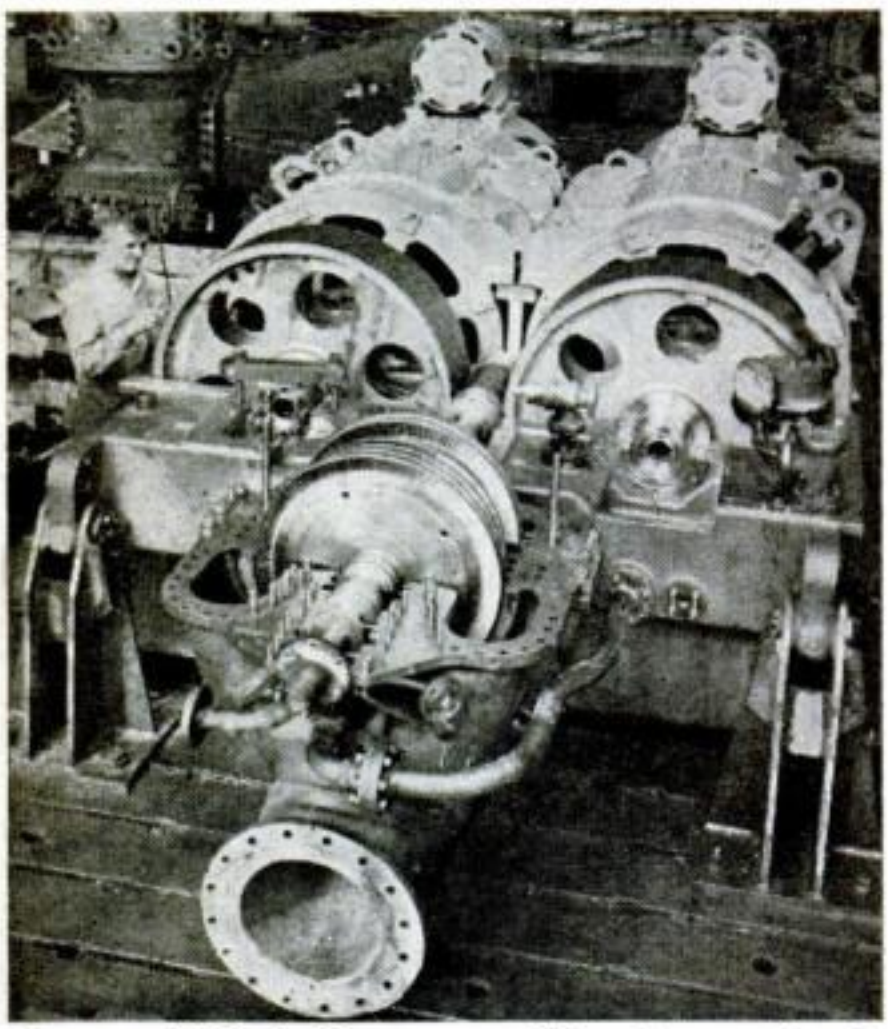
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In this new Chesapeake and Ohio locomotive, steam from coal-fired boilers turns a turbine.

powdered coal and high-pressure air then will be fed to a combustion tube to be burned and transformed into hot air and gases.

Any sand and grit in the hot gases will be removed by a fly-ash separator similar to the centrifugal filters used on Army tanks to whirl dust out of the air-intake tubes of their engines. From the ash separator, the superheated gases will flow to the gas turbine, which in turn will drive an electric generator to provide the power for the locomotive's driving wheels. The locomotive's speed will be controlled by regulating the flow of coal and air to the "atomizer."



Heart of C & O steam-turbine locomotive is the turbine in foreground. It drives two electric generators through twin reduction gears (center) to power motors that drive the wheels.

Such a coal-burning gas-turbine locomotive, according to Yellot, would have an efficiency of about 20 percent. This seems low until you consider that the average over-all efficiency of a present-day coal-burning steam locomotive seldom is much more than 5 percent. Compared on a fuel-cost basis, the 20-percent-efficient coal-burning gas-turbine locomotive would far outrun the Diesel-electric. On a dollar's worth of fuel, the coal turbine would outdistance the Diesel two to one.

Today, locomotive research engineers are concentrating their work on the potentialities of the gas turbine. What tomorrow will bring is pretty much anyone's guess. There may be a tip-off in a recent statement by Robert B. McColl, president of the American Locomotive Company:

"Our research staff is keeping itself well informed on all new developments *including atomic power*, admittedly more remote, but still a possibility not to be overlooked."

Better hold your hats when the old iron horse gets a diet of atomic oats. END

Jets Slightly Delayed

ALTHOUGH engineers have known of the jet principle since the days of Heron of Alexandria at the start of the Christian era, inadequate materials delayed its practical use until after the beginning of World War II. Today, America's young jet industry has already outstripped the rest of the world combined in production capacity, says Westinghouse.

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Adjustable Coat Speeds Tailoring

A SHORT CUT to tailor-made suits has been invented by an Australian tailor who realized that most men are irked by the repeated fittings necessary to produce a perfect garment. Thanks to an adjustable master coat, the customers of a custom-tailor shop in a suburb of Melbourne now receive a perfectly cut suit after only one visit.

The Simpson coat, developed by George Simpson and his son after years of research, is a form-fitting jacket made up of 11 separate panels that follow the natural contours of the body instead of the seams. These panels are joined by expanding measuring tapes, in chromium-plated spring tape holders, that allow the master garment to adjust itself to the differing proportions of various clients.

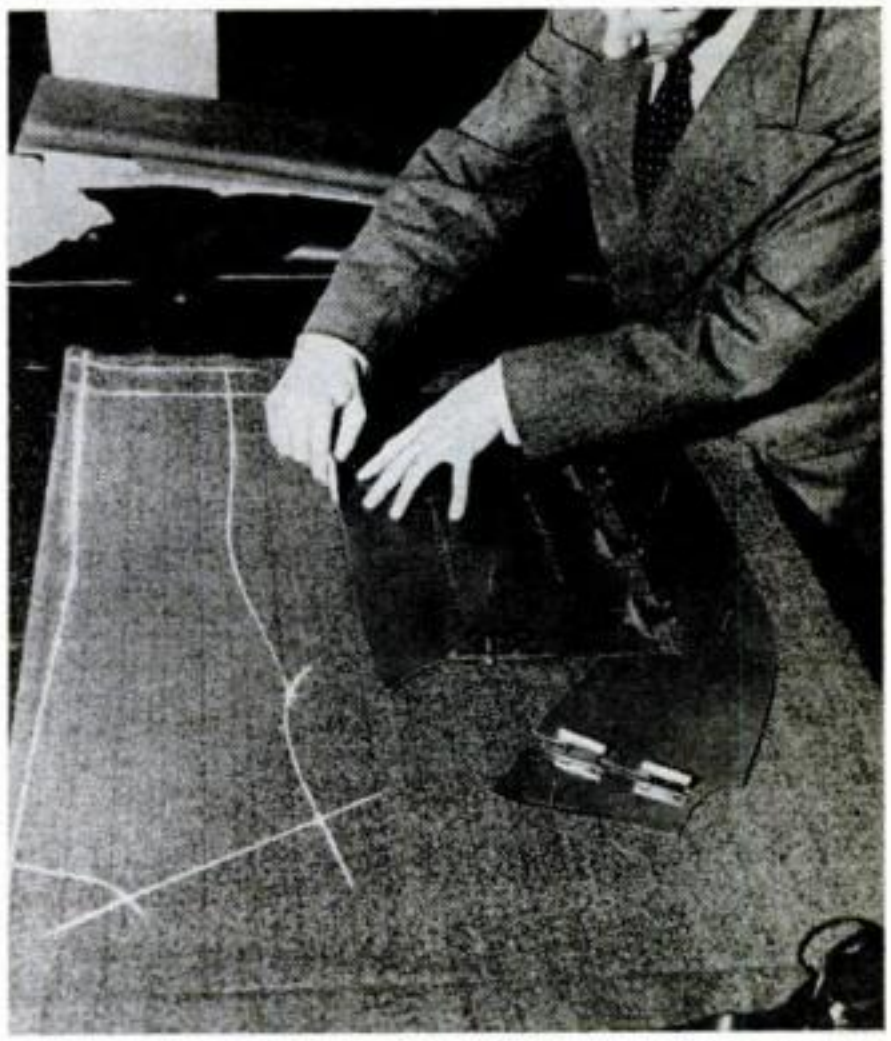
As the tailor reads the measurements on the 42 expanding tapes, he is able to determine exact variations from the standard coat. Further measurements on a graduated scale are given by a metal attachment that follows the curve of the chest to the underarm point. The father-and-son tailor team plans to manufacture the master garments and rent them out to other tailors.



Here the master garment is being modeled by George Simpson, Jr., while his father adjusts the expanding tapes. The device can be used for both single- and double-breasted coats.



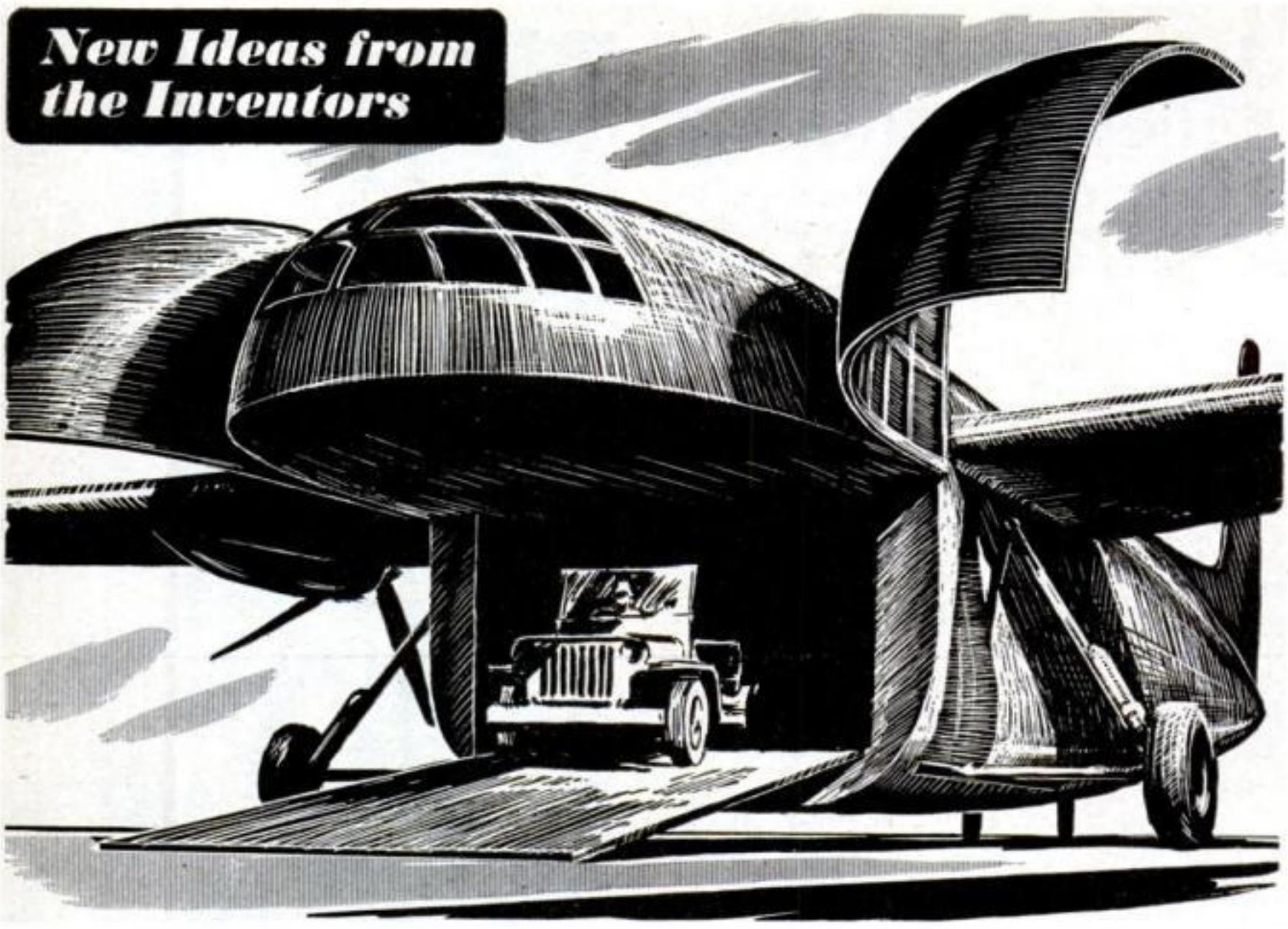
A rear view of the self-measuring tailor's aid, which its inventor claims will revolutionize the tailoring of men's suits. Planning divisions of the separate panels was most difficult job.



Correct measurements of the master garment are reproduced on a master pattern, also fitted with expanding tapes and slides. Above, this pattern is shown being used to mark material.

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New Ideas from the Inventors



Cargo Plane Stoops to Load. No hoists or heavy ramps would be needed to load or unload this plane—it simply pulls up its wheels and squats. The landing gear can be partly retracted on the ground to lower the fuselage. Curved doors in the nose then open upward, providing direct and easy access to the cargo compartment. C. Lemonier, of East Aurora, N. Y., and S. Payne, of Kenmore, N. Y., are the inventors.



Car Seat Carries Baby. Packing Junior along on those long auto trips would be a lot easier with this seat, patented by B. Glatstein, of Muscatine, Iowa. When a panel in the front of the backrest is pulled down, it forms a baby's seat. A similar panel in the rear of the seat can be lowered, so that the two together form a small bed.



Hand Pump Clears Drains. Water and suction are teamed up in this invention by C. Davis, of Los Angeles, to clear clogged sink drains. A flexible cup is pumped up and down over the drain by a handle hooked under one faucet for leverage. Meanwhile, water squirts into the drain from the other faucet through a hose in the cup.

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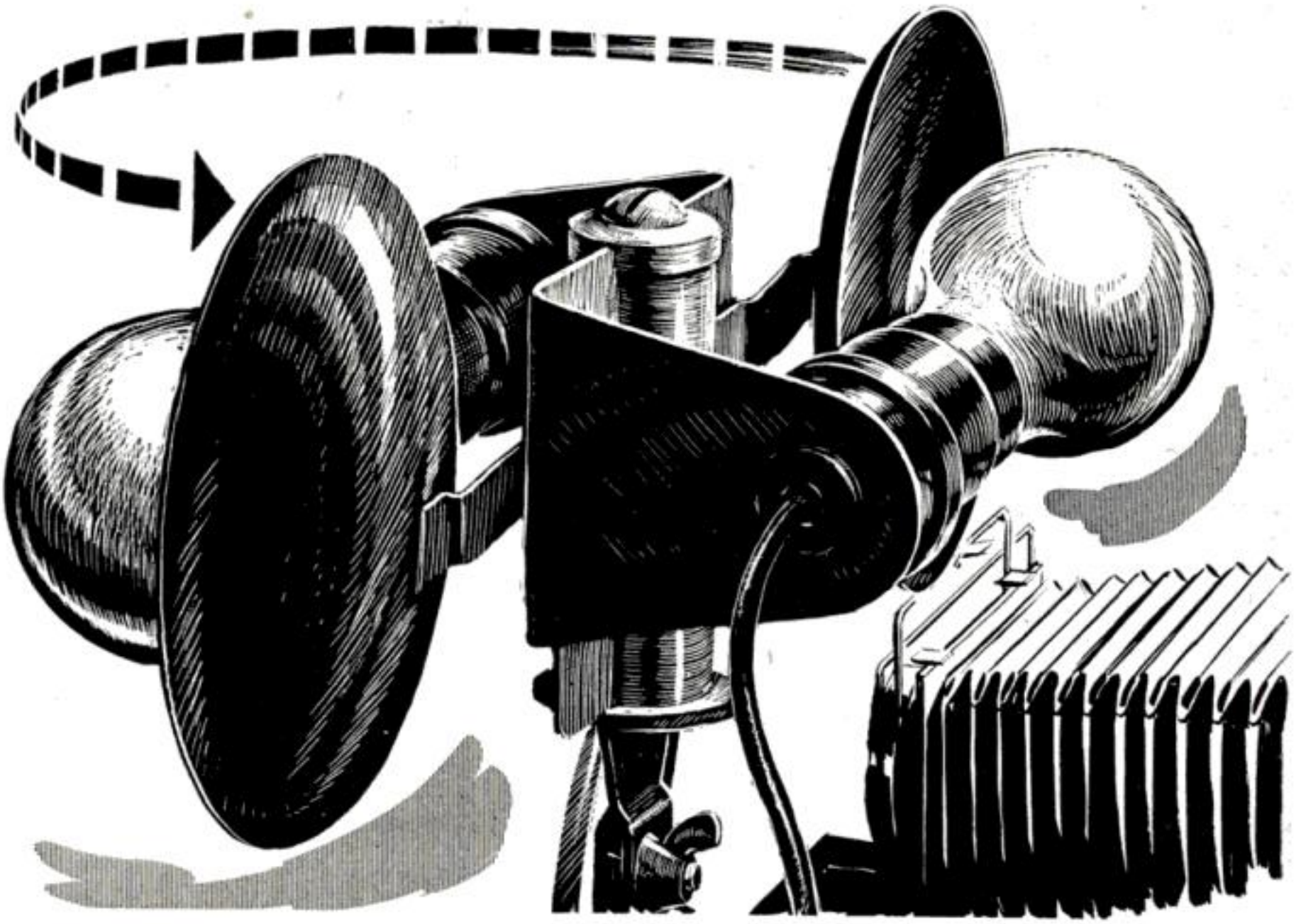
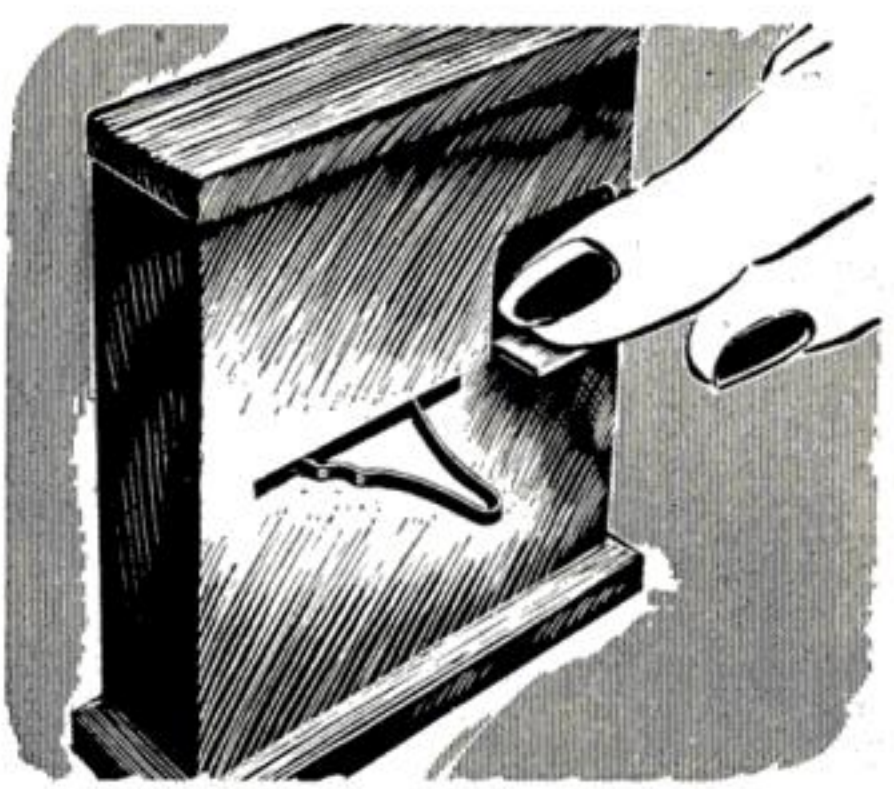


Photo Aid Aims Flash. A photographer wouldn't have to guess where his flash will hit with this double-headed light assembly. He could test direction and coverage with an ordinary bulb in one reflector, then simply rotate the second reflector—which holds a flash bulb—until it locked in the same position. Invented by R. McMath, of Pontiac, and S. Menzel, of Detroit, Mich., the device tilts to any angle.



Shoulder Trigger Fires Gun. No need to fumble for the trigger when firing this gun—just pull it back against your shoulder. Invented by E. Zryd, of Beloit, Ohio, it has a spring-seated butt plate connected to the trigger by a rod running through the stock. When pushed in, the plate trips the trigger, firing the gun.



Dispenser Spreads Bobby Pins. Fewer chipped teeth for bobby-pin users is the object of this spreader patented by R. Sharp, of Carville, La. It holds a stack of bobby pins on an upright blade. Pushing down on a handle twists one bobby pin at a time against the blade, spreading it apart and pushing it out through a slot in the side.

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Controlling Atomic

VISIBLE SMOKE STREAM

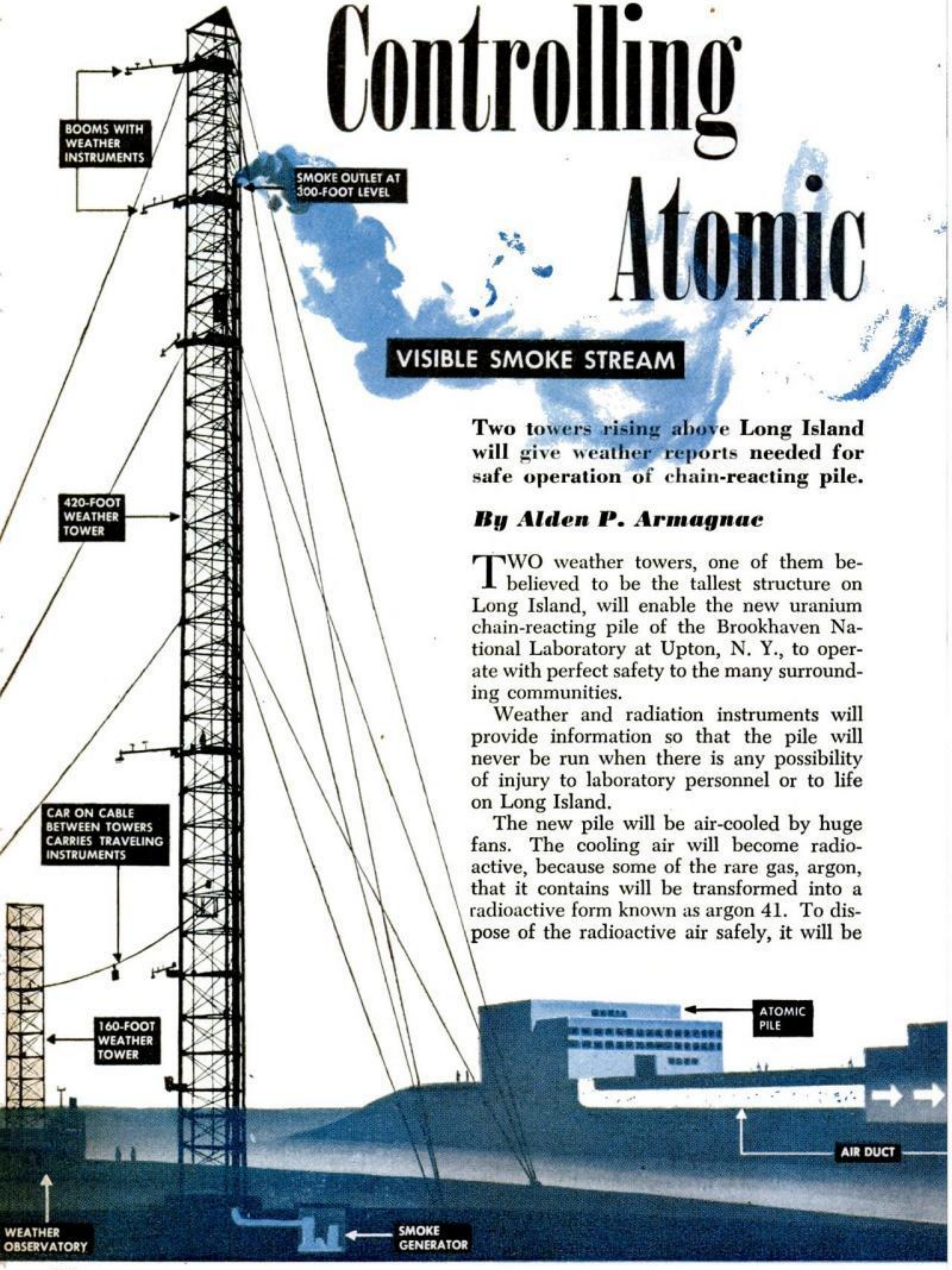
Two towers rising above Long Island will give weather reports needed for safe operation of chain-reacting pile.

By Alden P. Armagnac

TWO weather towers, one of them believed to be the tallest structure on Long Island, will enable the new uranium chain-reacting pile of the Brookhaven National Laboratory at Upton, N. Y., to operate with perfect safety to the many surrounding communities.

Weather and radiation instruments will provide information so that the pile will never be run when there is any possibility of injury to laboratory personnel or to life on Long Island.

The new pile will be air-cooled by huge fans. The cooling air will become radioactive, because some of the rare gas, argon, that it contains will be transformed into a radioactive form known as argon 41. To dispose of the radioactive air safely, it will be



Close-up of weather tower's smoke pipe shows one of two windows through which observer can see that smoke generator is operating properly. Outlet is at height of top of nearby air stack.



Gases

INVISIBLE STREAM OF RADIOACTIVE AIR

exhausted through a 300-foot stack, resembling a lighthouse, on a nearby hill.

The radioactivity lasts only a short time, half of it vanishing in less than two hours. Normally the air from the stack will rise, and so not drift back to earth before all effective radioactivity has disappeared.

Design of the towers and operation of the unusual weather service has been worked out by the Brookhaven Meteorological Group, headed by Norman R. Beers. Each tower is of triangular shape; they reach to heights of 420 feet and 160 feet respectively.

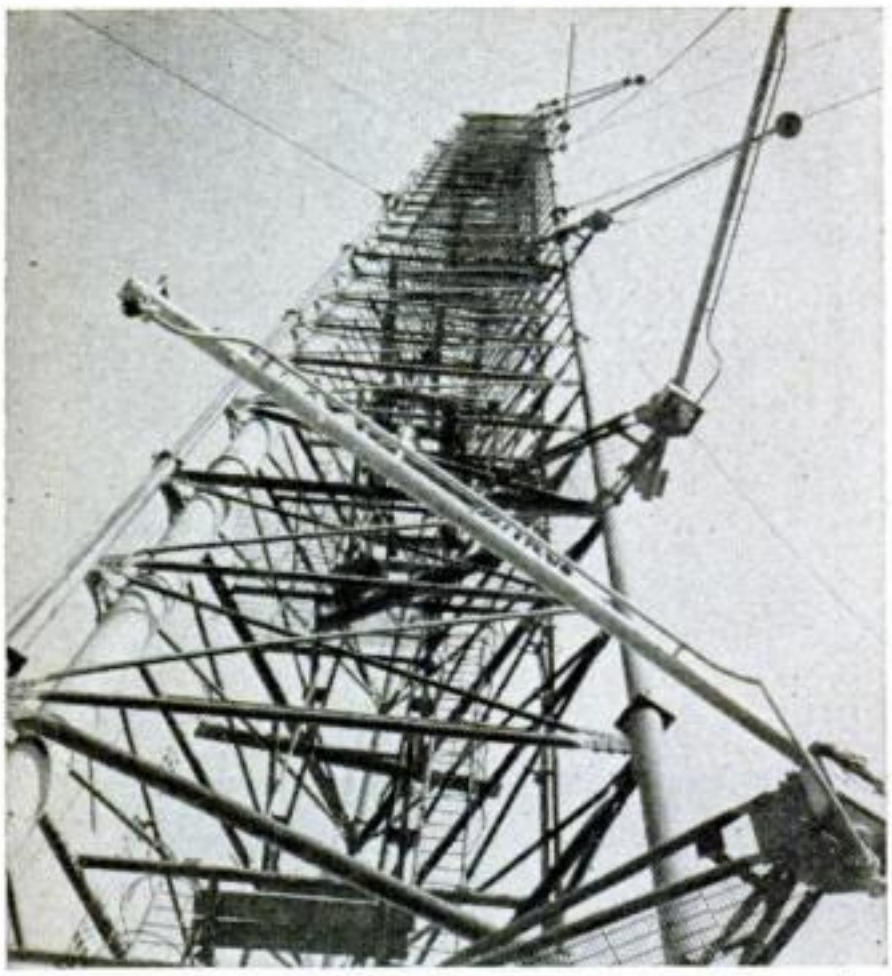
On the taller tower, a smoke pipe rises exactly to the level of the nearby air stack. White smoke from an Army M-1 smoke generator, in a pit near the base of the tower, will frequently be discharged from the lofty outlet of this pipe. By watching the drift of the smoke, observers can see just what will be happening to the invisible gases from the air stack.

At various levels on each tower, booms carrying remote-indicating weather instru-

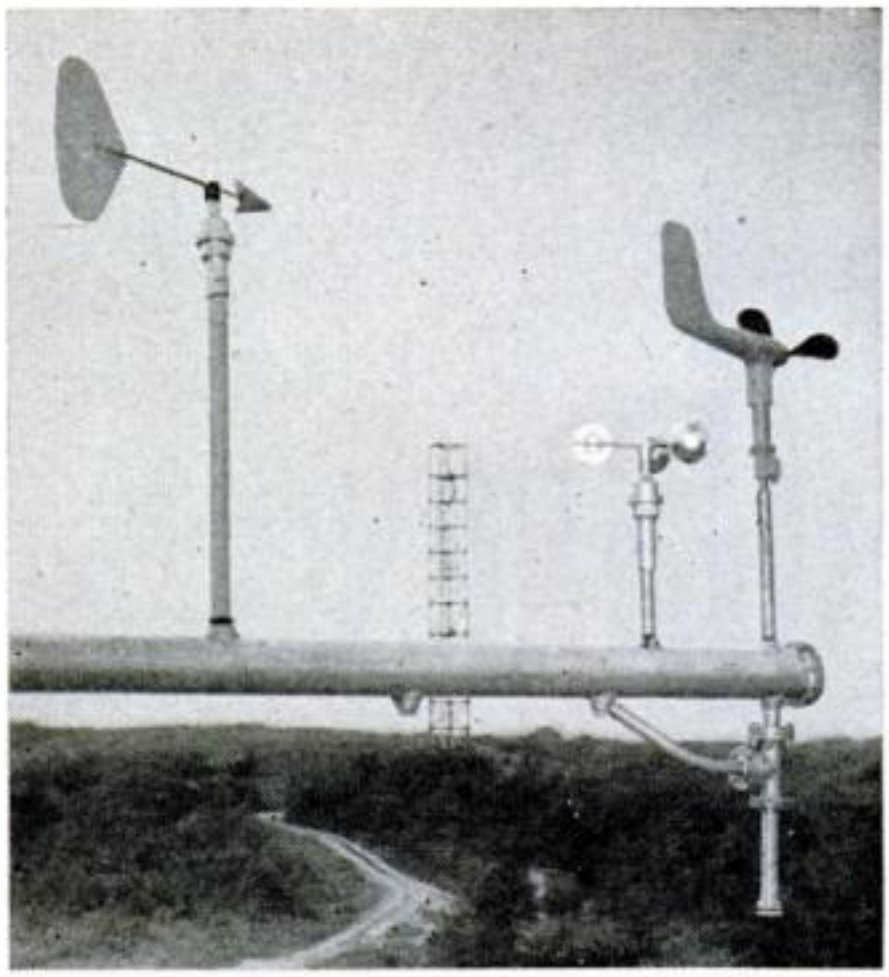


Smoke plume from Brookhaven weather tower gives observers a visible check that radioactive air from atomic pile is borne away at safe distance from earth. Operators will run pile only when air from stack will not settle on or near the ground, as shown by weather and radiation instruments under constant observation.

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Skyward view of 420-foot weather tower under construction shows adjustable booms for weather instruments at various levels. Instruments had not been installed when photo was made.

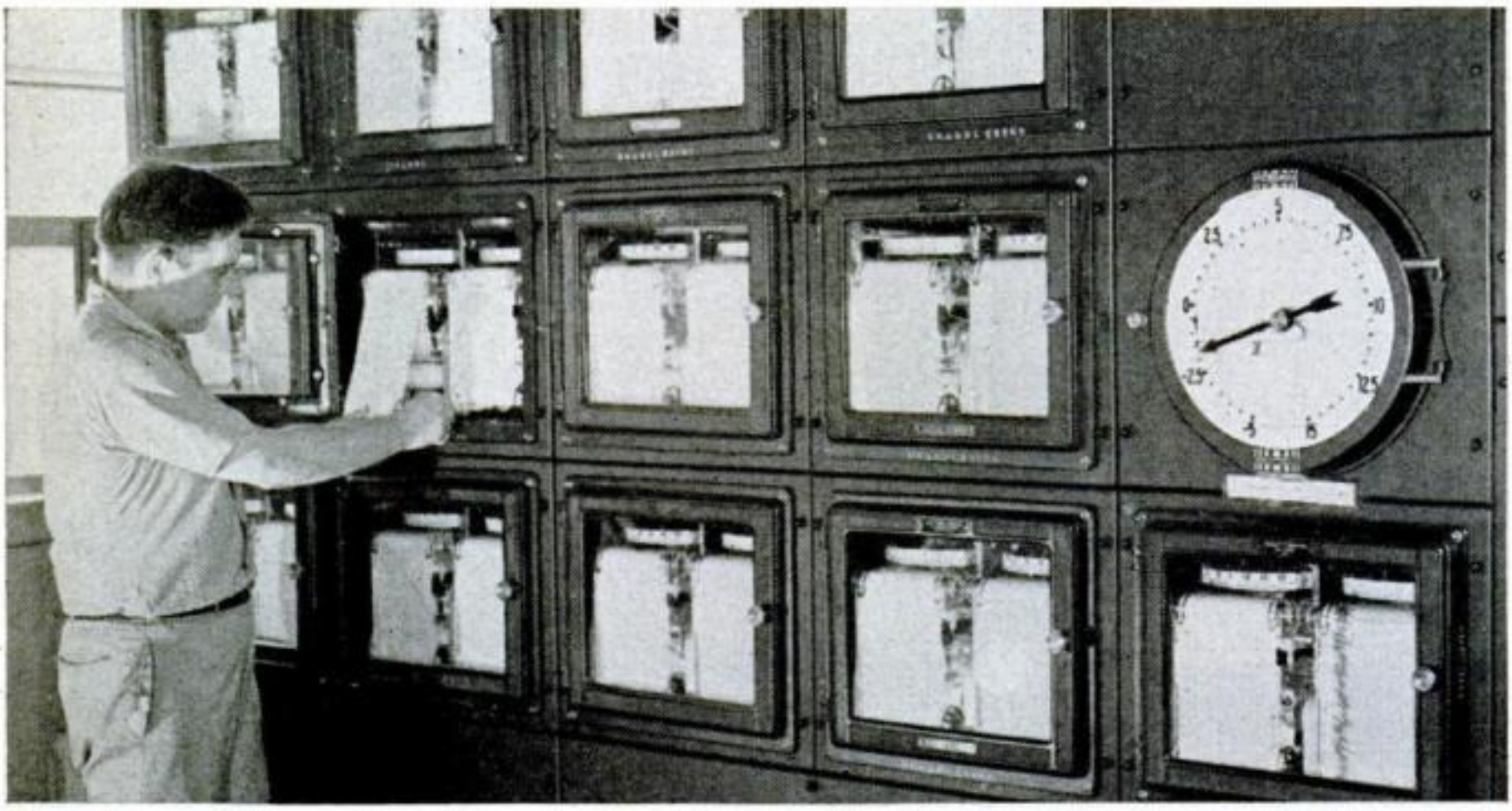


Typical weather instruments on this boom include, left to right, wind vane, anemometer, combination wind speed and direction indicator, and, below it, electrical thermometer.

ments may be swung out by hand wheels to any desired angle so that the tower structures will not affect their readings.

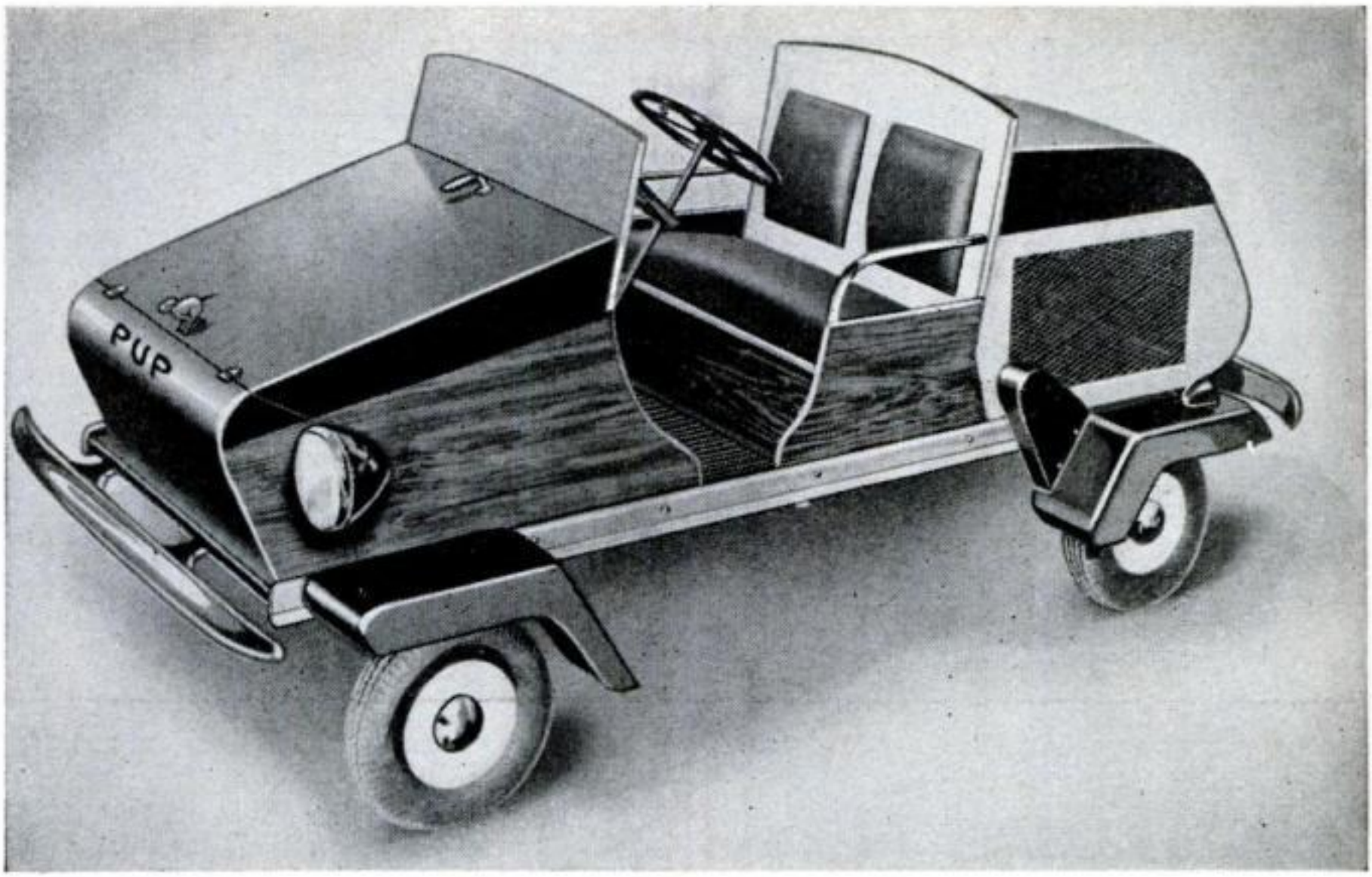
On a cable stretched at about 100-foot height between the two towers, additional instruments will ride on a self-propelled electric carriage. These will register variations in air conditions along a horizontal line, just as the instruments on the tower booms show variations with height.

For access to the equipment aloft, an elevator in each tower will carry scientists up and down. This will seldom be necessary, however, since all instrument readings are continuously registered on a central panel in an observatory building several hundred feet distant. There observers will watch them 24 hours a day. END



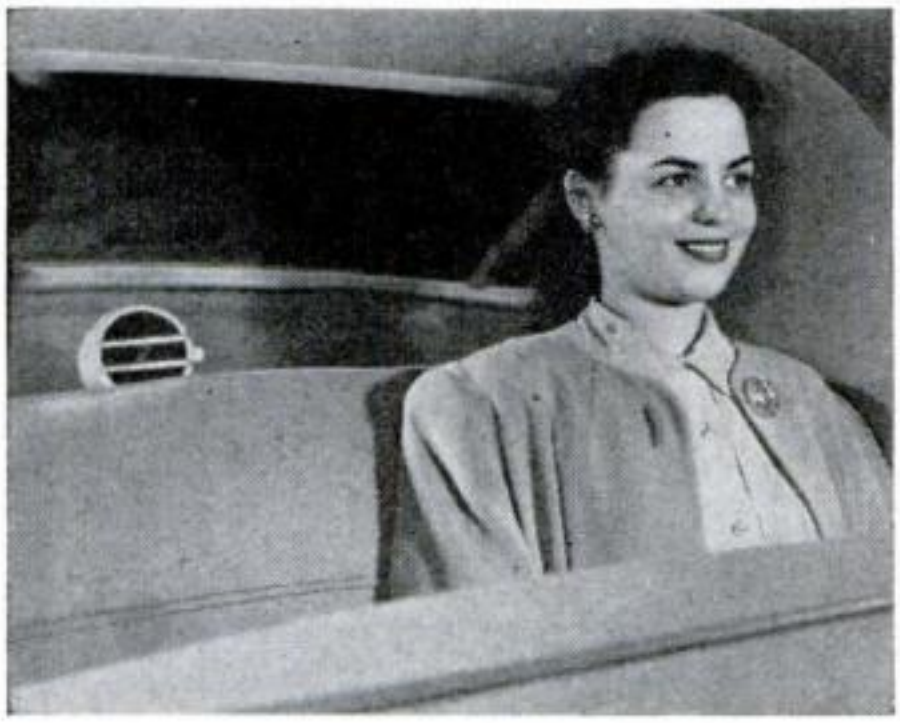
Central panel in weather observatory enables observers to watch the readings of all the instruments on both towers. Charts show wind speed and direction and air temperature at all levels. Clocklike instrument at right is a temperature-difference indicator showing directly the variation with height. Observers on duty day and night safeguard operation of the pile.

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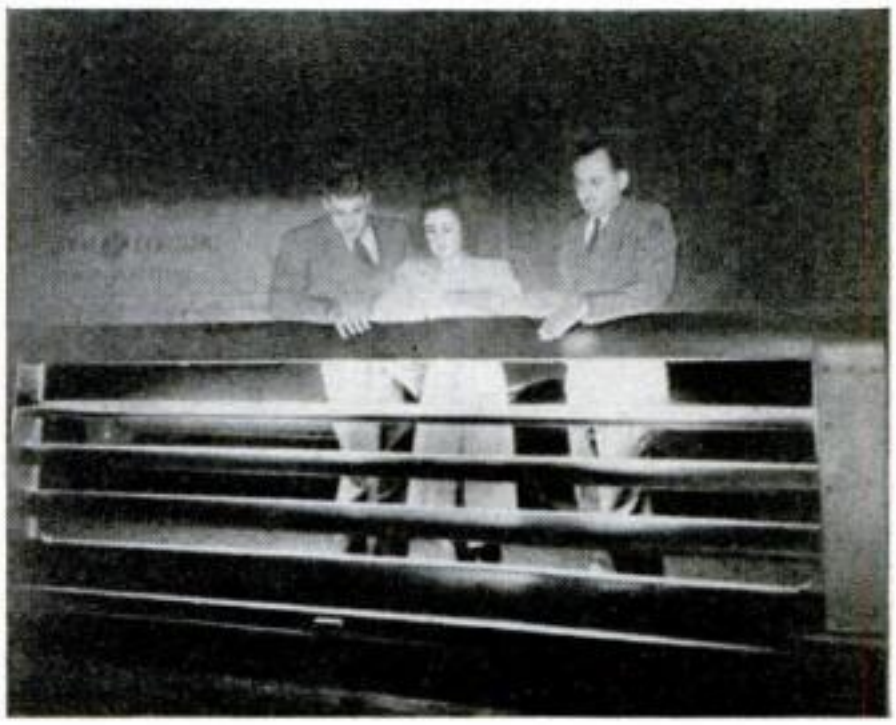
New Car Weighs 600 lb.

LATEST entry among the flyweights, the 600-lb., two-passenger auto above claims up to 60 miles to the gallon. Its engine—either a 7½-hp., one-cylinder job or a 10-hp., two-cylinder one—is in the rear, with luggage space in front. An automatic clutch is standard. Made by Pup Motor Car Co., of Spender, Wis., the car is 8½ ft. long on a 6-ft. wheelbase. List prices are reported as $500 to $600 f.o.b.



Radio Piped to Back Seat

DRIVERS of Ford-made automobiles can now distract their back-seat drivers with sweet music. Fords, Lincolns, and Mercurys from 1946 to 1949 can be equipped with a back-seat speaker that feeds the radio right into passengers' ears. It also keeps high frequencies usually lost in car noise. About the size of an alarm clock, the new speaker has a spring clip and a 20-ft. cord, so that it can be taken out and set up at a distance.



Guard Rail Lights Road

THESE guard rails do a double job. Besides keeping unwary tourists from plunging over the edge of Shasta and Grand Coulee Dams, they light their path by night. Fluorescent lamps 6 to 8 ft. long are being installed under the semi-circular top rail of glistening steel, and their light will blanket the entire roadway without glare. General Electric prepared the lighting setup for the Bureau of Reclamation.

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MARCH OF SCIENCE



Light, Air Bake Enamel. Both infra-red rays and hot air are used to bake the enamel finish on metal parts in General Electric's new test oven. The combination is expected to produce better finishes, since some enamels require the quick heating of the infra-red lamps at the start, followed by the lower, even temperature that the hot-air units can provide. The hot air is blown in, while 288 lamps inside give the radiant heat.



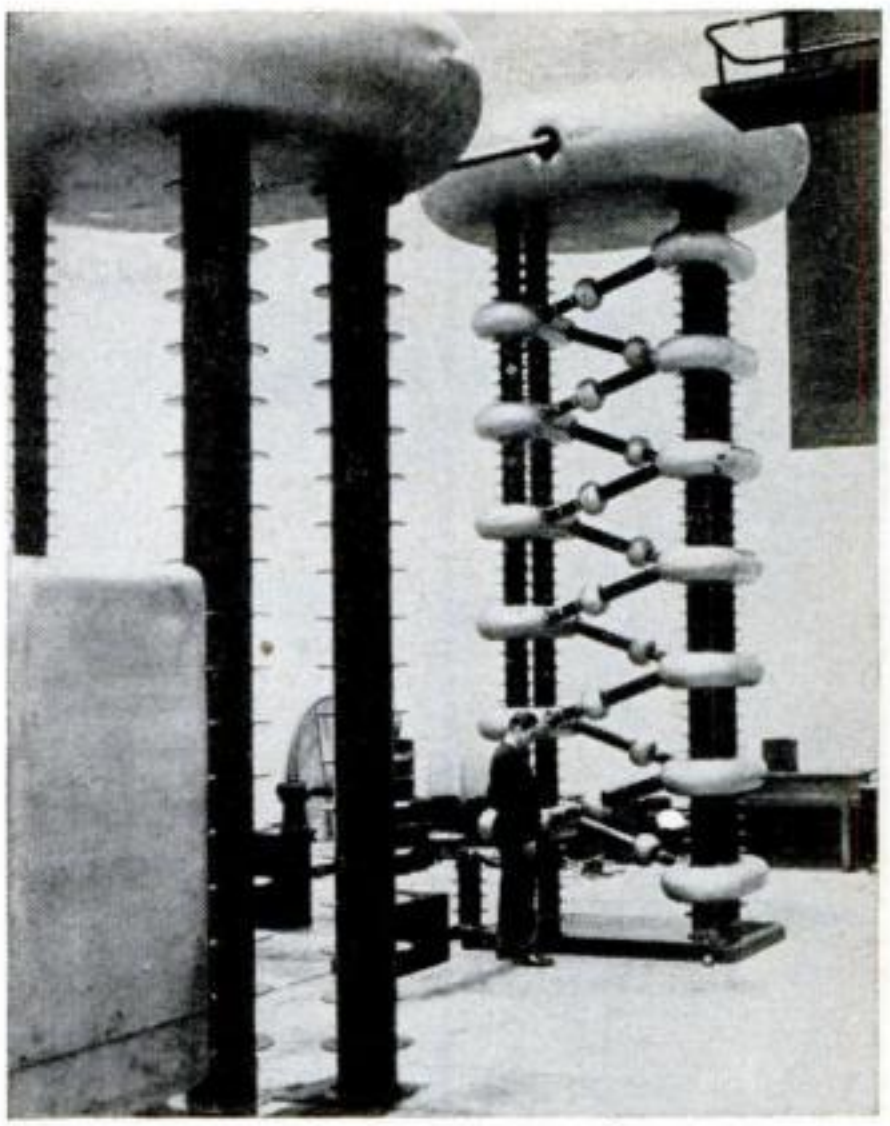
Cryostat Freezes Helium. This super-refrigerator turns out liquid helium—at about -452° F.—as easily as your kitchen box turns out ice cubes. It now is aiding research near absolute zero (PS, Aug. '47, p. 77). Until development of this cryostat—apparatus for maintaining low temperatures—by Arthur D. Little, Inc., and Dr. S. C. Collins of MIT, liquefying helium required a laboratory full of expensive equipment.

Separator Counts Drops. A machine that automatically separates individual compounds from mixtures of biological solutions, counting each drop with a photo-electric cell, is speeding the search for new medicines at Sharp and Dohme research laboratories. Shown below, it makes use of the fact that some compounds stick better to "adsorbing" surfaces than others.

Early Indian Unearthed. This Indian (below) had slept peacefully for 15 centuries—until Wisconsin citizens decided to build a road over his grave. A crew working near Madison unearthed the skeleton. It was identified as belonging to the Hopewell culture, a civilization that flourished around 500 A.D., by Dr. Andrew Whiteford (center), anthropologist of Beloit College.

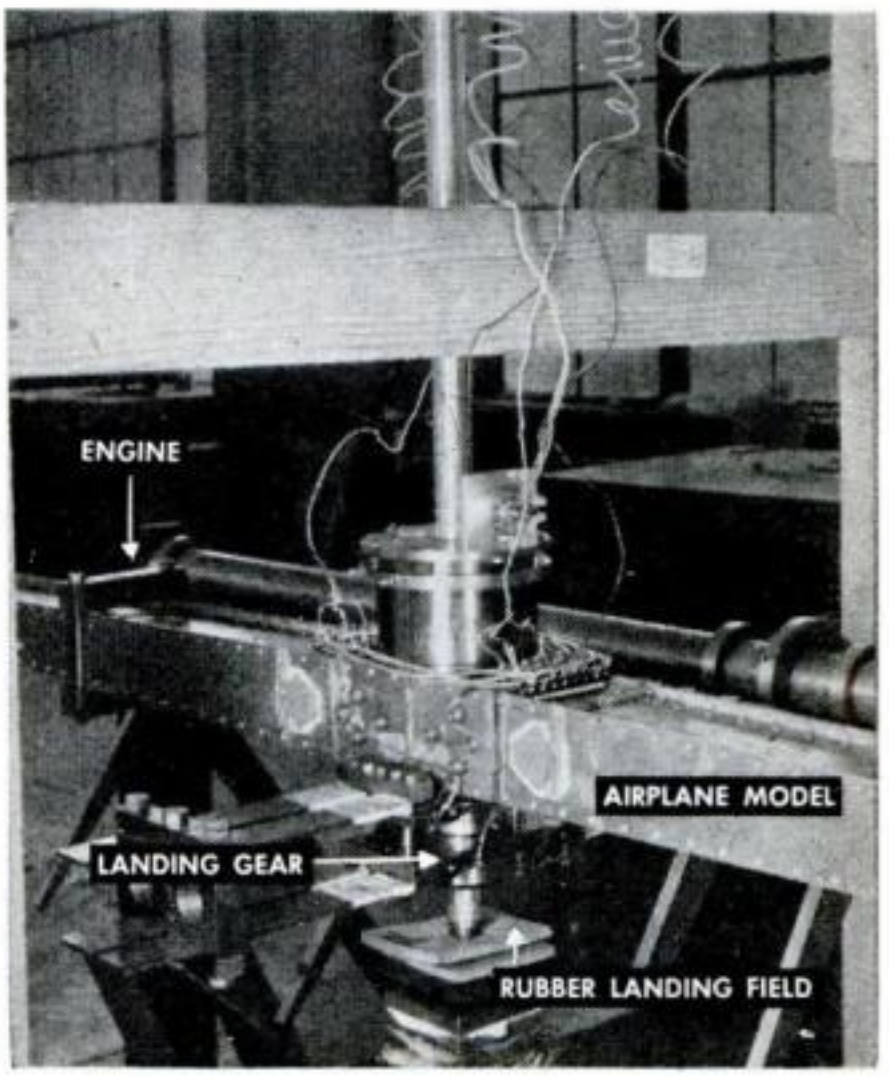
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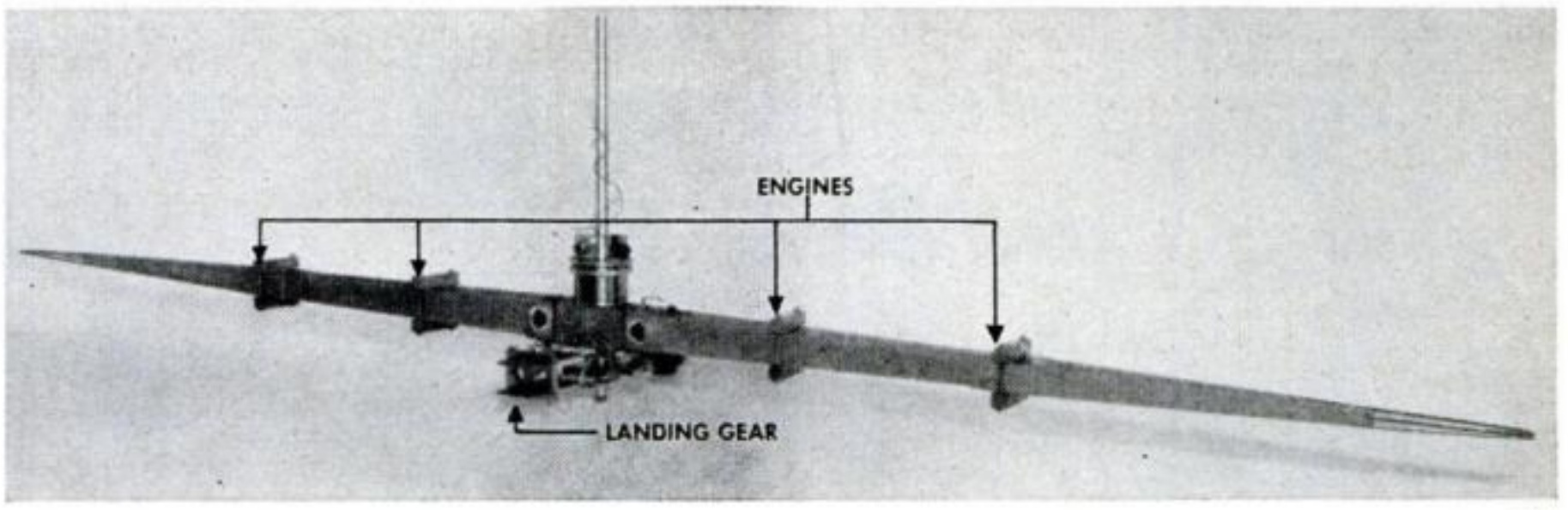
Britain Gets Atom Buster. Able to fire nuclear particles at energies of a million electron volts, Britain's latest atom smasher is shown at right being checked by an engineer who helped to build the giant machine for the Clarendon Laboratory, in Oxford. A step in the expansion of nuclear research sponsored by the government's Department of Scientific and Industrial Research, it will be used in a study of the light elements. These are being used because they are easier to break up than heavy elements and give results that are simpler to understand. The new atom smasher will speed protons or deuterons—the central cores, or nuclei, of hydrogen or heavy hydrogen—to the million-electron-volt energy and then let them fly at the target atoms. Studies of the pieces chipped off the target nuclei by this attack give information useful in many applications of nucleonics.



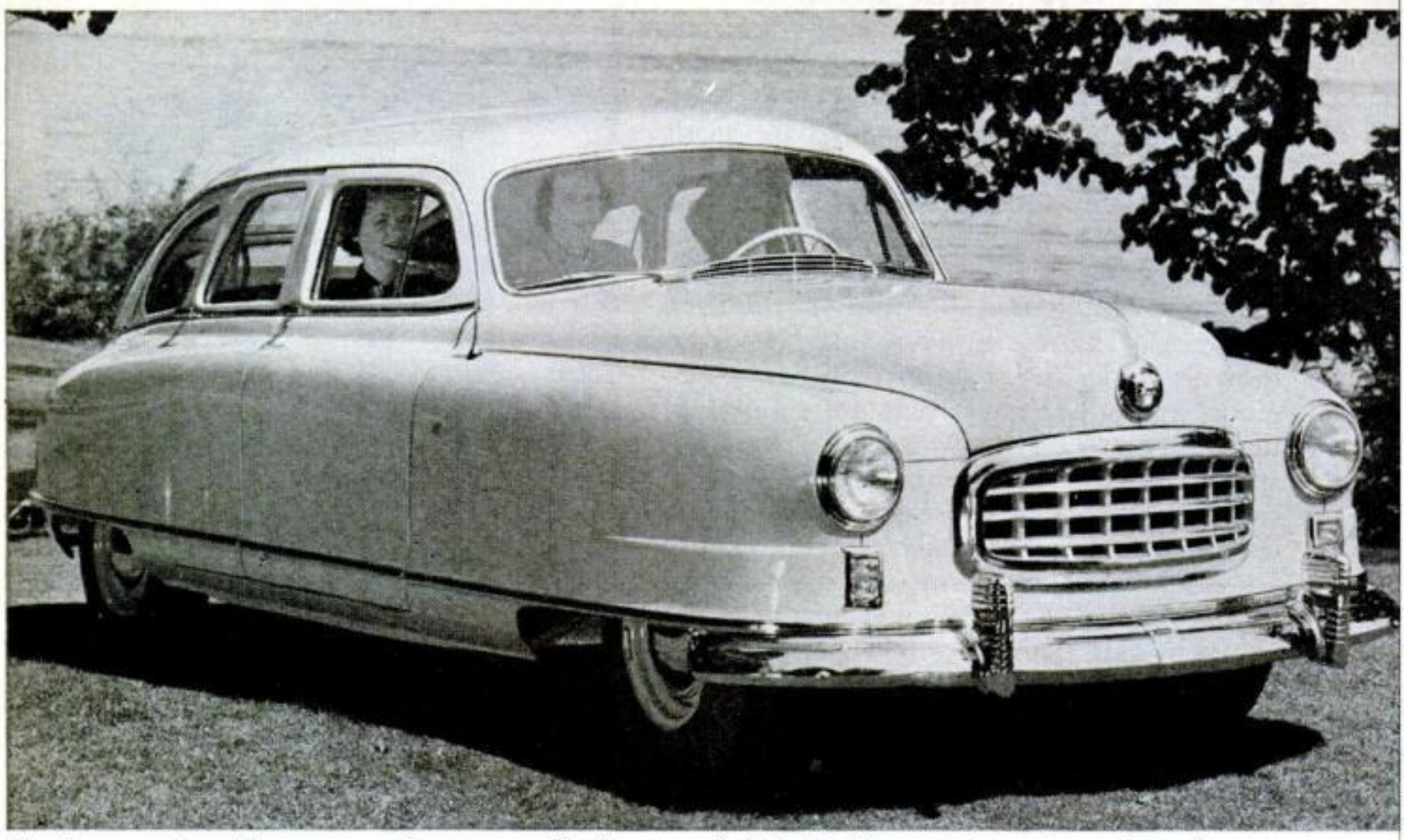
Model Plane Lands in Lab. An airplane model that doesn't look at all like an airplane is helping U. S. Bureau of Standards engineers figure out how to design real planes that won't shake apart from the vibration caused by landings. The model (below) is a long, tapered box beam made of aluminum sheet. Its dimensions are such that its weight distribution and flexibility are proportional to those of a big transport. It has weights placed to play the part of engines, and an imitation landing gear.

In the test (right), the model is dropped on a rubber "landing field"—the rubber simulates the flexibility of the tires—and the forces and twists caused by the impact are measured with electrical instruments. These are then compared with the results predicted by theoretical calculations. In that way the theory can be corrected so that designers are able to forecast how badly a big airplane will shake when landing.





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Fenders enclose front as well as rear wheels of 1949 Nash. Elimination of cutouts formerly needed to let them pivot on turns is made possible by setting them well inside fender line.

New Nash Swallows Its Wheels

By R. P. Stevenson

IT WAS only a matter of time until one of the established automobile makers put skirts on its cars' front wheels to match those on the rear. The 1949 Nash has them.

The first reactions of the car-hungry public to the new Nash models were:

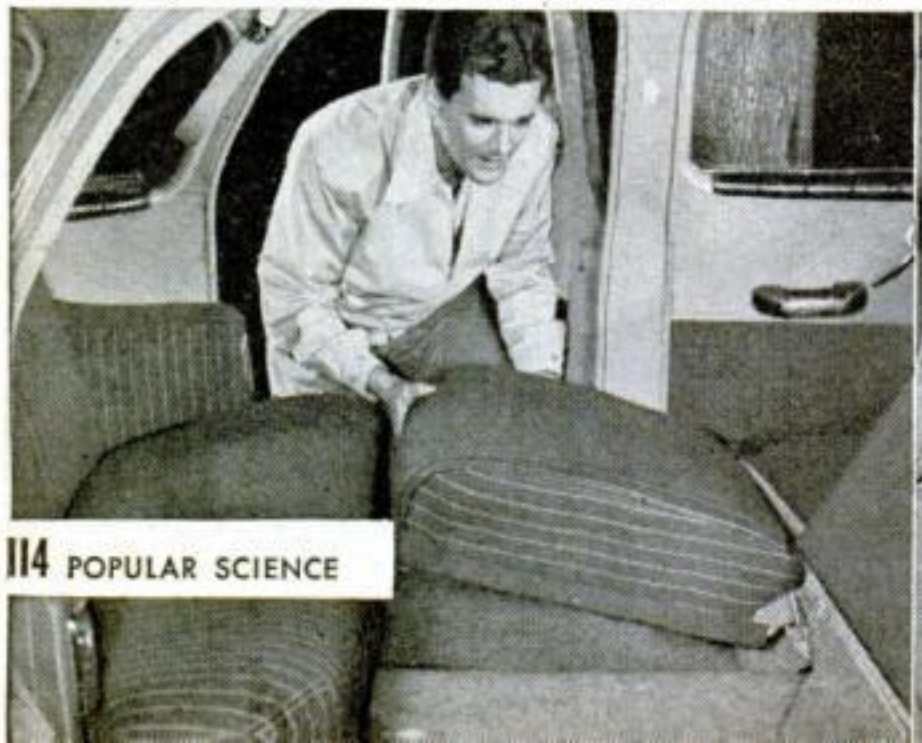
But how do you turn a corner?

How do you change a wheel?

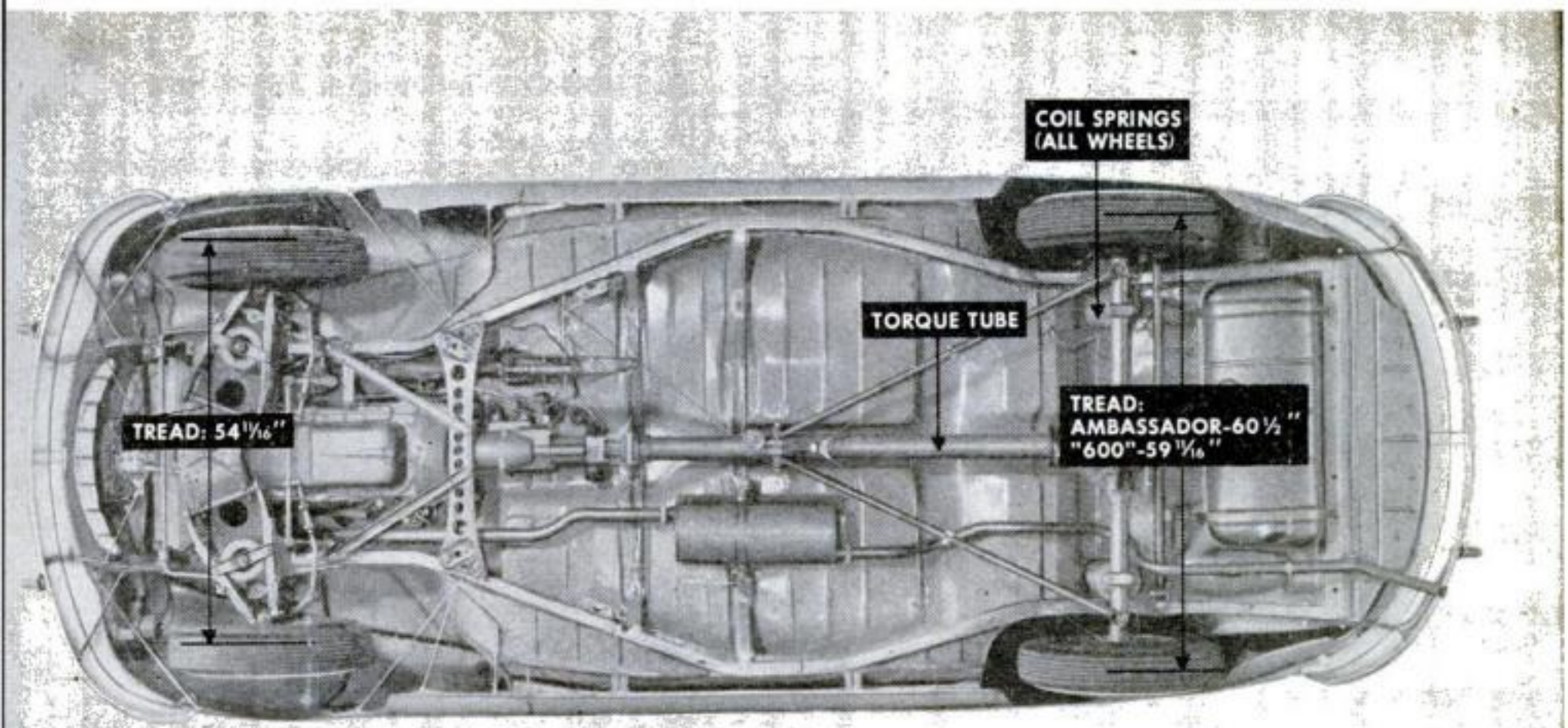
For the designers' neat solutions to both problems, see the accompanying photographs.

While the pontoon-type front fenders are the most obvious departure from previous designs, Nash—like most of the manufacturers making their first real bids for post-

Bed is made by swinging down back cushions of front seats, as shown at left below. Stops pull out from rear-seat cushions as supports. Accessory mattress then is laid on the three cushions, as at right below. Single bed uses only right half of split front seat. Two-door sedans come with bed-type front seats; buyers of four-doors must specify bed equipment.







View from underneath shows front wheels set about 5 in. closer together than rear wheels to permit enclosed-wheel design. Company says this doesn't materially affect car's stability.

war business—has gone whole hog on its 1949 Airflyte ® models. They are the fancy-pants Ambassador, with 112 horsepower; and the 600 model, with 82 hp.

The silhouettes of both are lower than those of former years. Roofs have been dropped from 68 to 62 inches without reducing road clearance or interior headroom. "Lounge interiors," contributing to the trend toward regarding the family automobile as an extra room for the home, are 9 ft. 4 in. long. The front seat is 5 ft. 3 in. wide; the rear, 5 ft. 1 in.

Again this year, Nash is emphasizing its automobile "bedroom." Drop the back of the right front seat, spread a mattress, and you've got a full-length single bed that can be occupied while the wheels eat up the highway. Drop the backs of both front seats and you have a full-size bed for an overnight stop. Unlike previous Nash models, the '49s have beds that can be made up without lowering the back of the rear seat or digging into the luggage compartment.

Standard equipment on both cars includes the new low-pressure tires. An improved version of the Nash-originated Weather Eye ® air-conditioning system provides a complete change of air every two or three minutes with the windows closed.

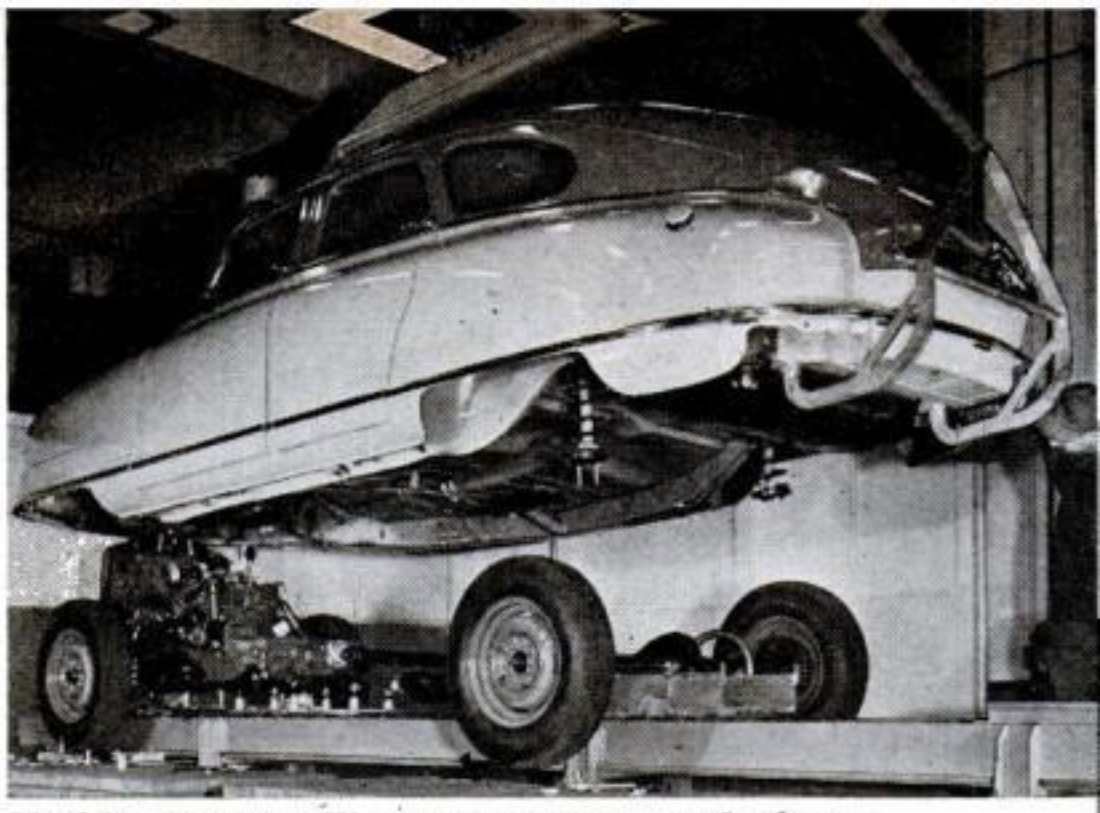


Bluntly rounded tail of new Nash has stop and direction-signal lights mounted on lower edge of trunk lid. Inside, at left, is red light visible to approaching drivers when the lid is up.

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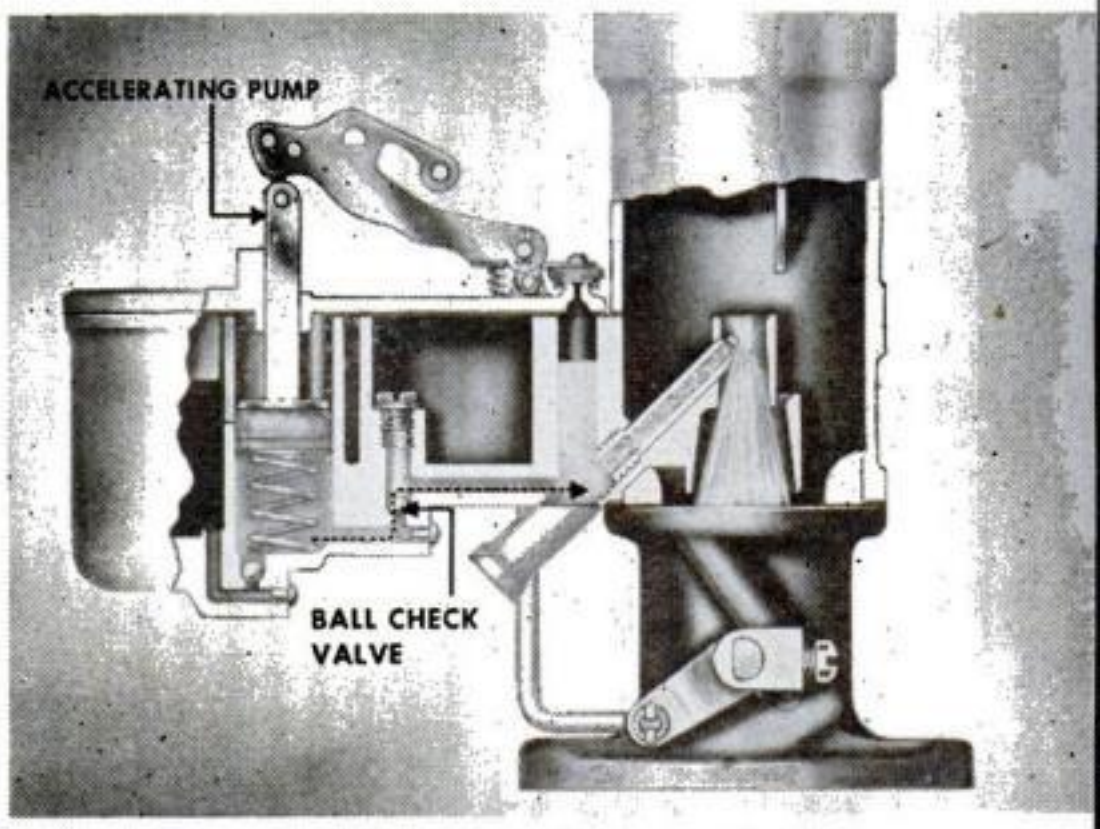
Removing a front wheel is no more of a job on the 1949 Nash than taking off a skirted rear wheel. Lower edge of the fender is high enough for easy access to hub cap and wheel studs.



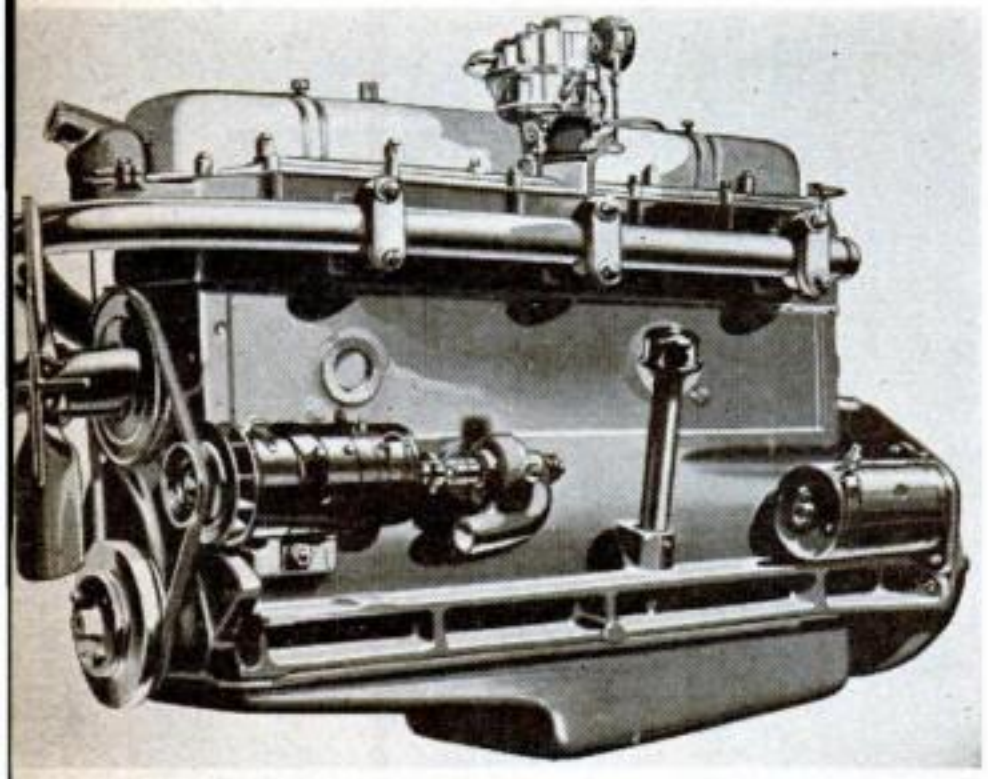
Nash's "unitized" construction, with frame and body welded into a single steel unit, is demonstrated in this view of simulated assembly line. Coil springs are used all around.



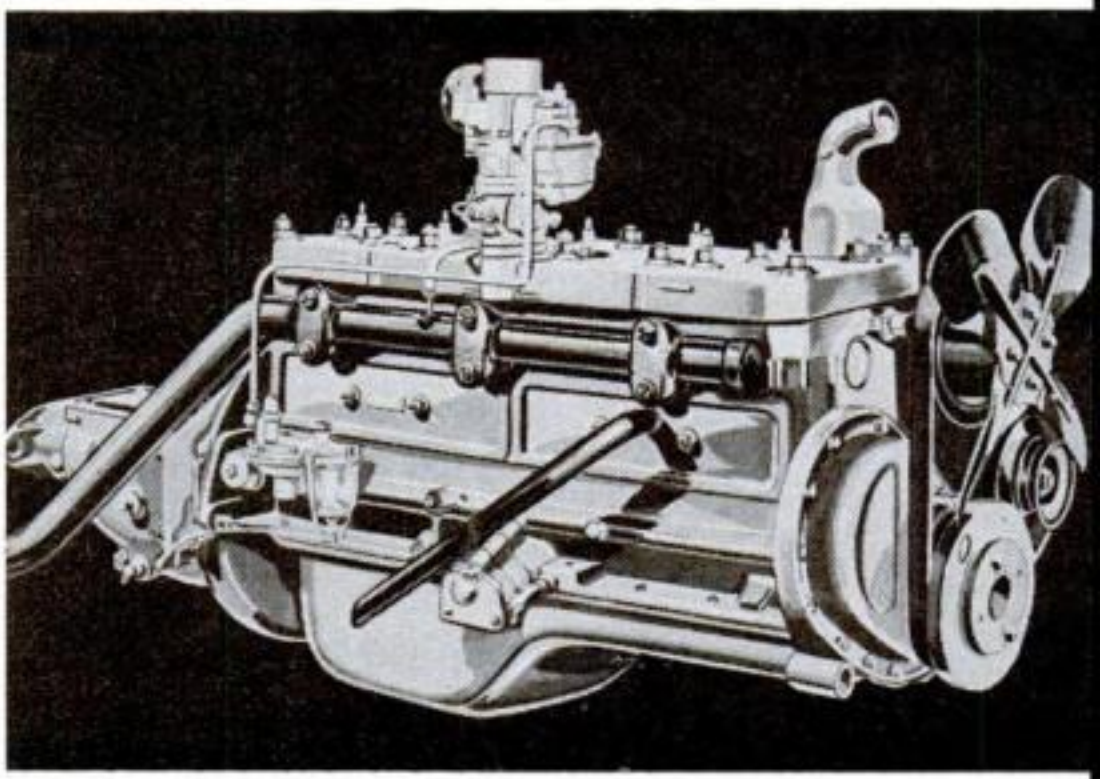
Unique in Nash is airplane-type container for instruments, called Uniscope℗, mounted on steering column. Switch to control intensity of light is provided to reduce driver distraction.



New system of carburetion eliminates feeding engine an over-rich fuel mixture in acceleration. Accelerator pump discharges into passages between main jet and high-speed nozzle.

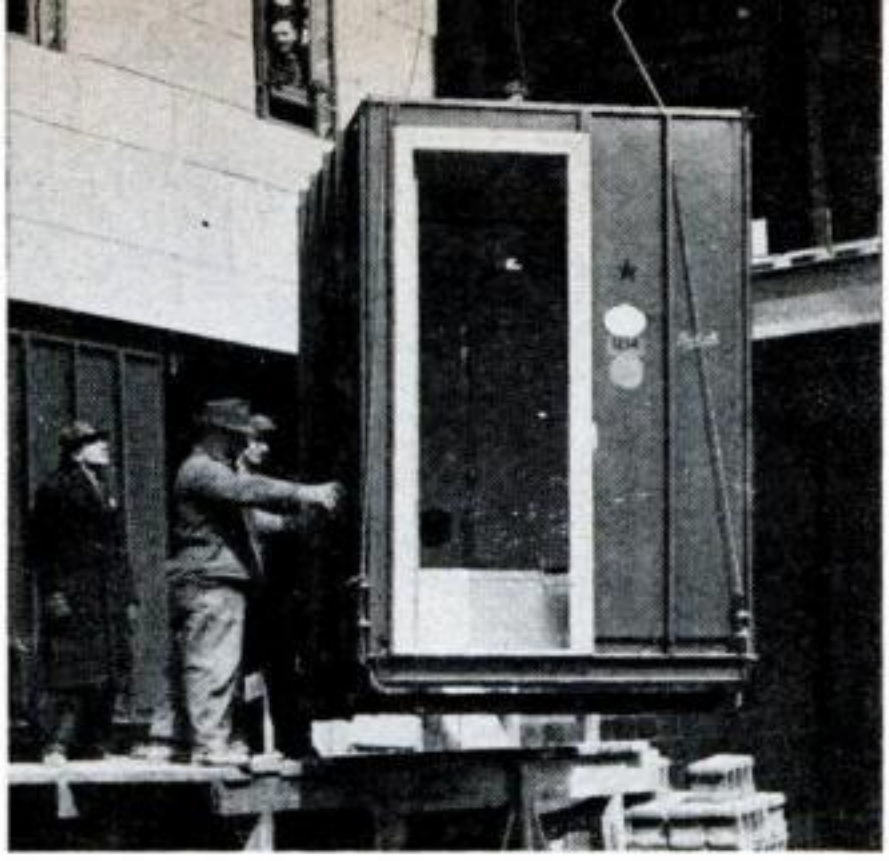


Ambassador model's crankshaft has seven bearings, adaptable to higher compressions. Cooling system has capsule of powder that expands with heat as its temperature-sensitive element.



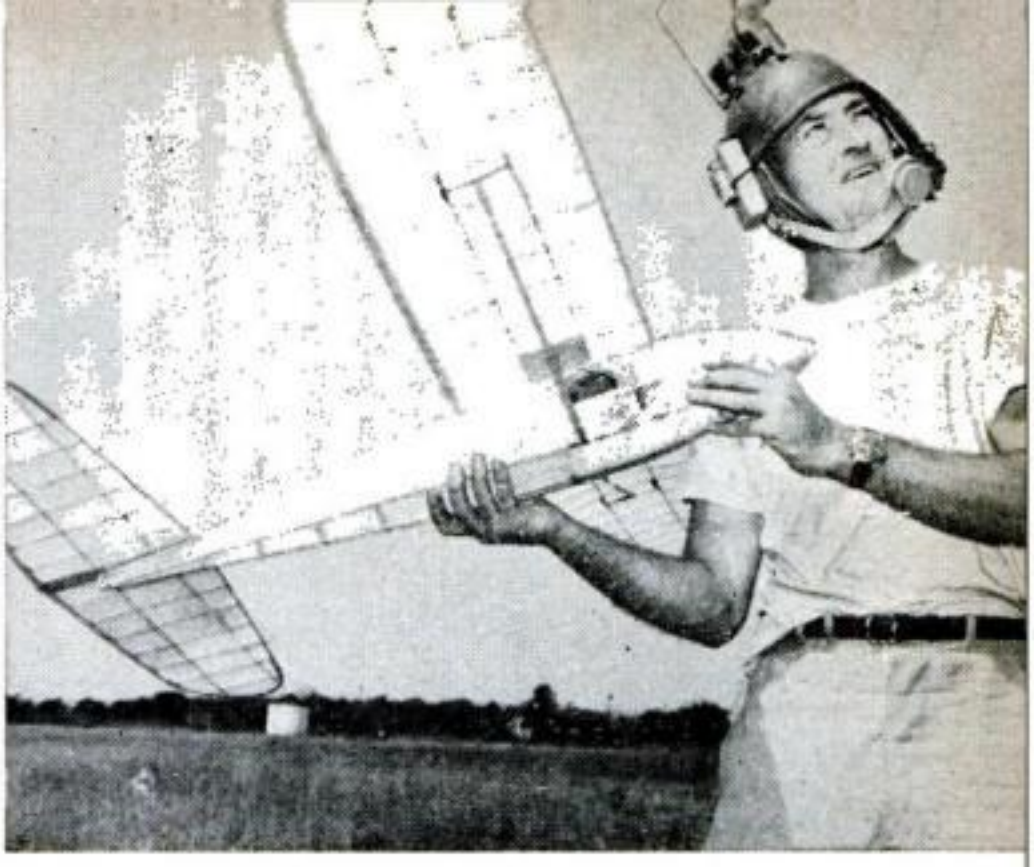
Engine of 600 model has stiffer crankshaft than last year's. Increased counterweighting gives better balance, greater smoothness. Four-ring pistons reduce oil consumption and wear.

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Hotel Gets 1-Piece Baths

ONE of 1,100 prefabricated bathrooms is hoisted into place to speed construction of the Laurentien Hotel in Montreal. Factory-assembled of steel and plastic, with all fixtures installed, it's ready to be bolted down and connected to the plumbing.



Under Your Hat

No man from Mars, this model-plane enthusiast wears his weird helmet to tote a radio-control transmitter. Converted from a football helmet, it has an aerial on top. The radio orders are picked up by a receiver under the wing of the gas-powered model.



New Yarn Outlasts Wool

HERE'S one rug no bug will be snug in. Woven from yarn made entirely of synthetic materials, it won't make a meal for even the most ravenous of moths. It won't bother persons who are allergic to wool, either.

Called Adoran ®, the new yarn is a chemical composition produced by an electronic process. In abrasion tests, rugs made of the yarn outlasted wool rugs of comparable quality by three to one. Because the yarn has a hard, smooth surface, it is said to shed dirt and be easier to clean.



'Scope Aids Marksmen

A MARKSMAN doesn't have to squint to pick out a target through this new 20-power spotting 'scope. The maker, Bausch & Lomb, says its 60-mm. aperature and improved optical system bring in a brilliant image, with pin-point definition, even when your eye is held a full inch from the eyepiece. This not only saves eyestrain but avoids the danger of banging your glasses against the eyepiece or jostling the 'scope out of alignment. Less than 14 inches long, the instrument fits easily into any shooting kit.

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Do You Know Your New Air Force?

Jet takes the lead in this array of new Air Force planes. See how many you can name, then check answers printed upside down across the bottom of the page.



1. Of conventional design, this was the first six-jet bomber in the world to be flown. The plane is still in experimental stage.



4. This one you should get easily. It's the most famous USAF jet fighter. There's an air scoop on each side of the fuselage.



5. Yes, it looks like the B-29 Superfortress, but it's really 75 percent new plane. Engines are more powerful, and range is greater.



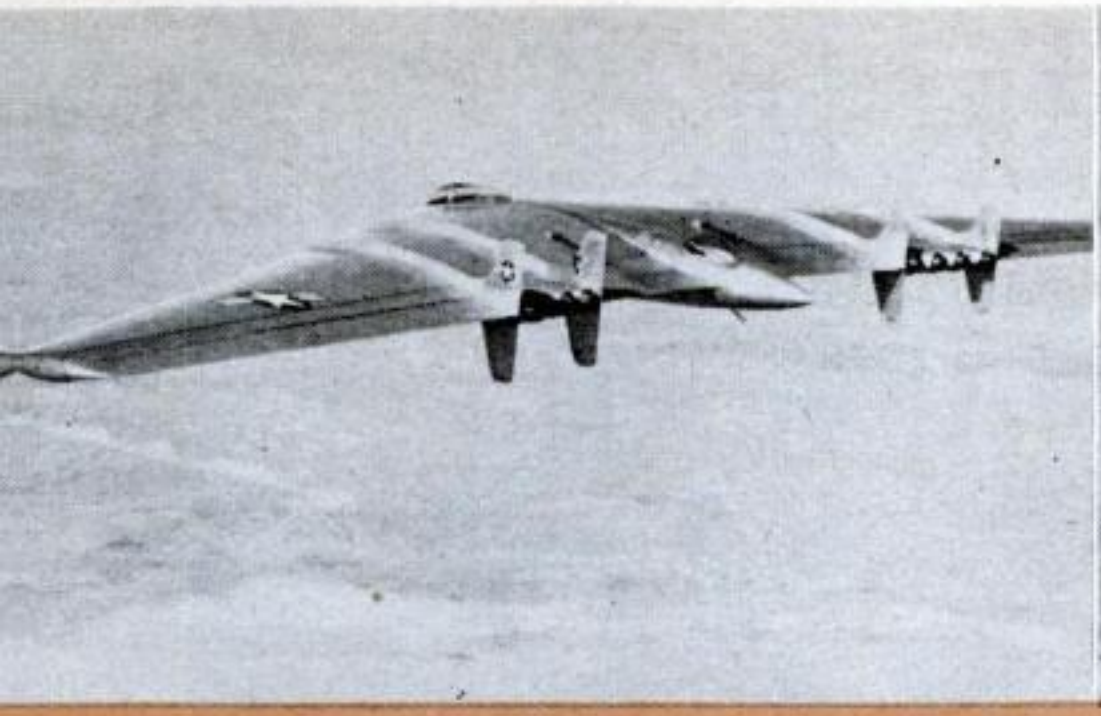
8. Called the world's largest bomber, it is designed to carry 10,000 pounds of bombs 10,000 miles. Note the six pusher props.



9. Air for the single jet engines of these fighters is sucked in through the nose. Their speed is rated at more than 600 m.p.h.

7. Boeing XB-47; 8. Consolidated B-36; 9. Republic F-84; 10. Consolidated XB-46; 11. North American B-45.

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2. There should be no mistaking this tailless, propellerless craft. Note the eight jet exhausts of this new long-range bomber.



3. The Air Force is getting this new plane ready for production. An all-weather, jet-propelled fighter, it has a speed of 600 m.p.h.



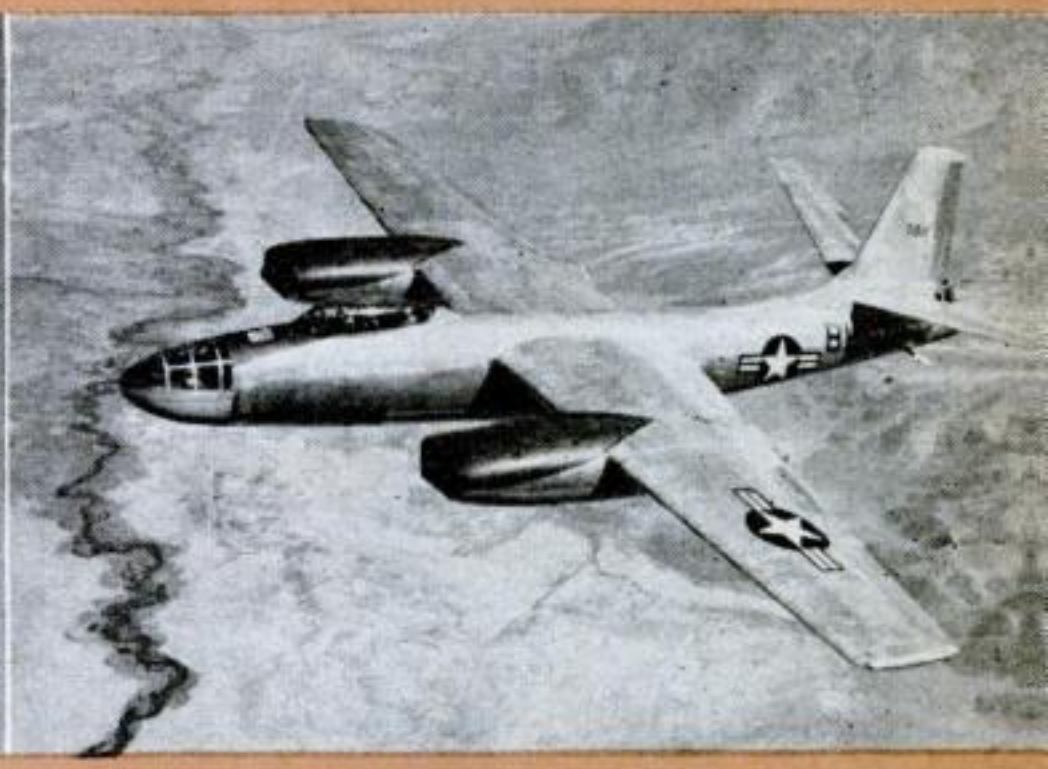
6. A single jet engine powers the world's first fighter with sweptback wings. It is designed to fly faster than 650 m.p.h.



7. Sweptback wings again, but this time it's a bomber with six jet engines slung under the wings. It's still in experimental stage.



10. It may look like a twin-jet fighter, but there are two jet power plants in each of this huge new bomber's two nacelles.

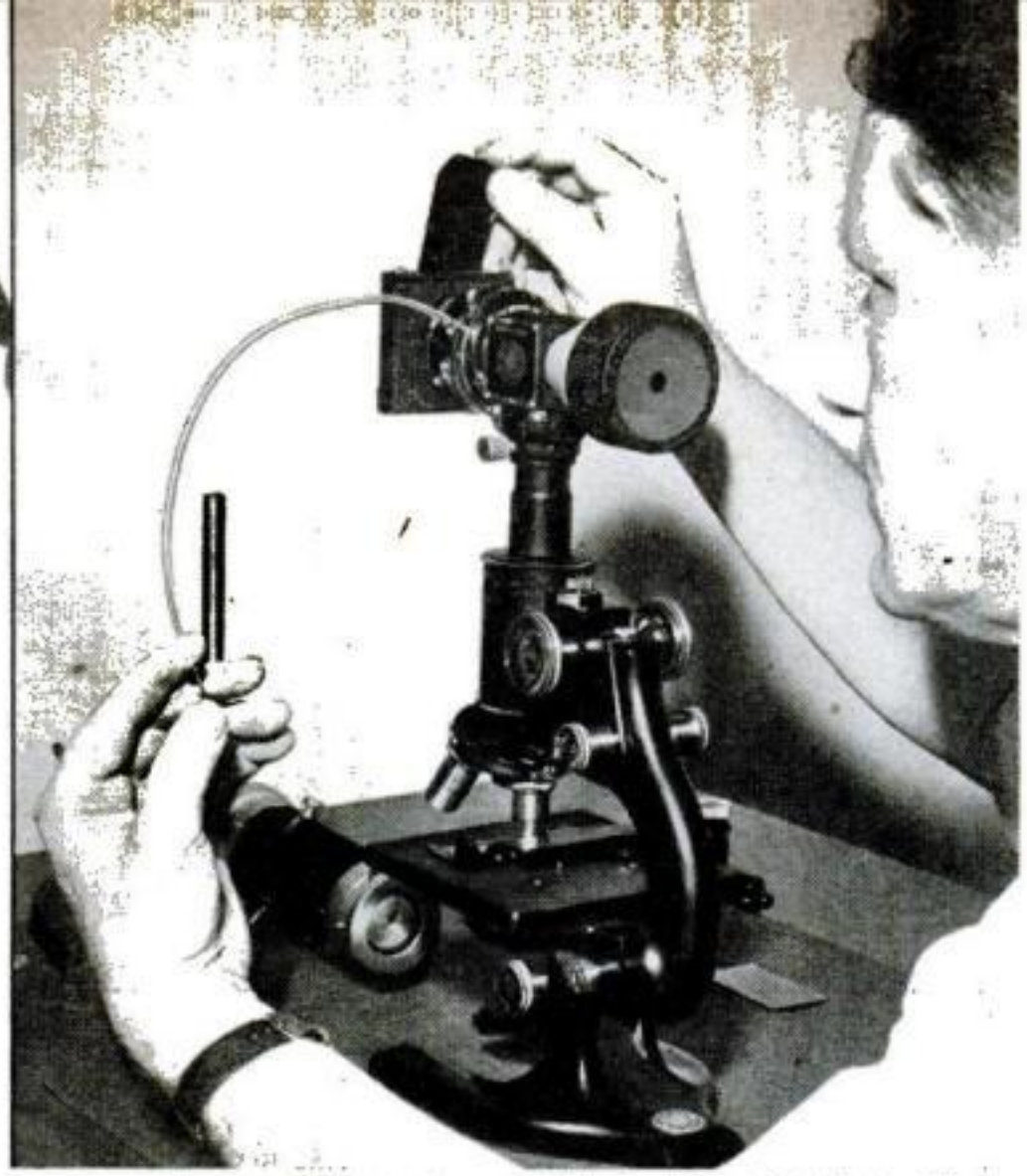


11. This medium bomber also has a slender fuselage. It is powered by four jet engines that speed it along at close to 500 m.p.h.

1. Martin XB-48; 2. Northrop B-49; 3. Curtiss XF-87; 4. Lockheed F-80; 5. Boeing B-50; 6. North American F-86;

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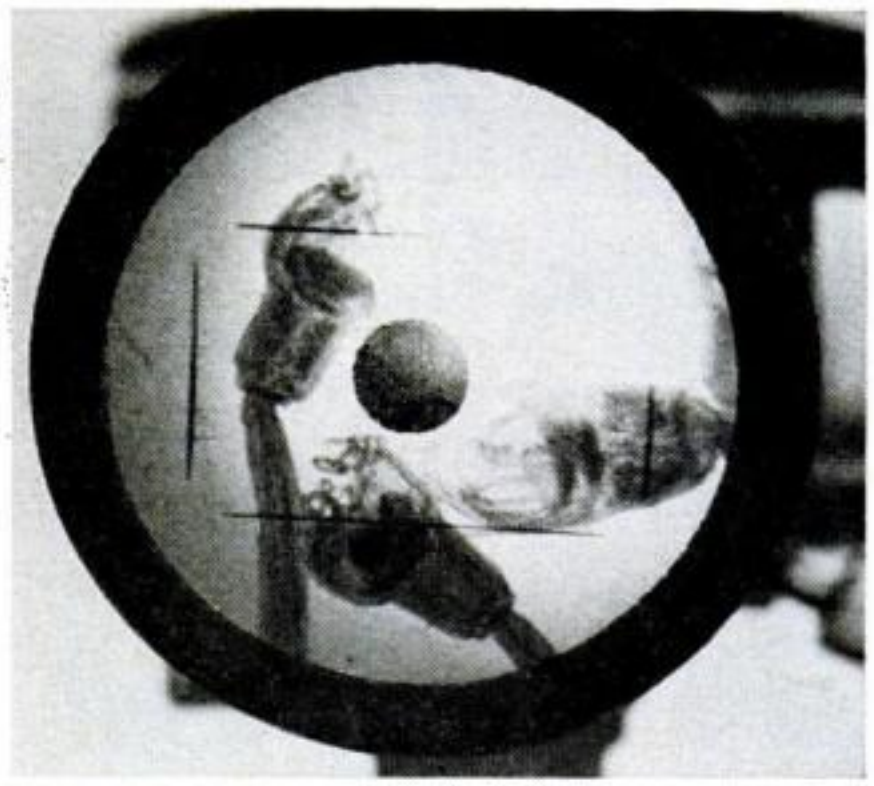
Microscope camera weighs only 12 ounces, is easily attached to top of eyepiece with single screw (left). Adapters permit it to fit nearly any microscope. After image is focused on viewer, film is inserted in holder (right). Shutter is tripped by ordinary cable release. Film-holder can be replaced with some types of standard cameras after removal of their lenses.

Lensless Camera Lets Microscope Make Photo

You can take a picture of a germ as easily as snapping a pretty girl with this photographic attachment for microscopes.

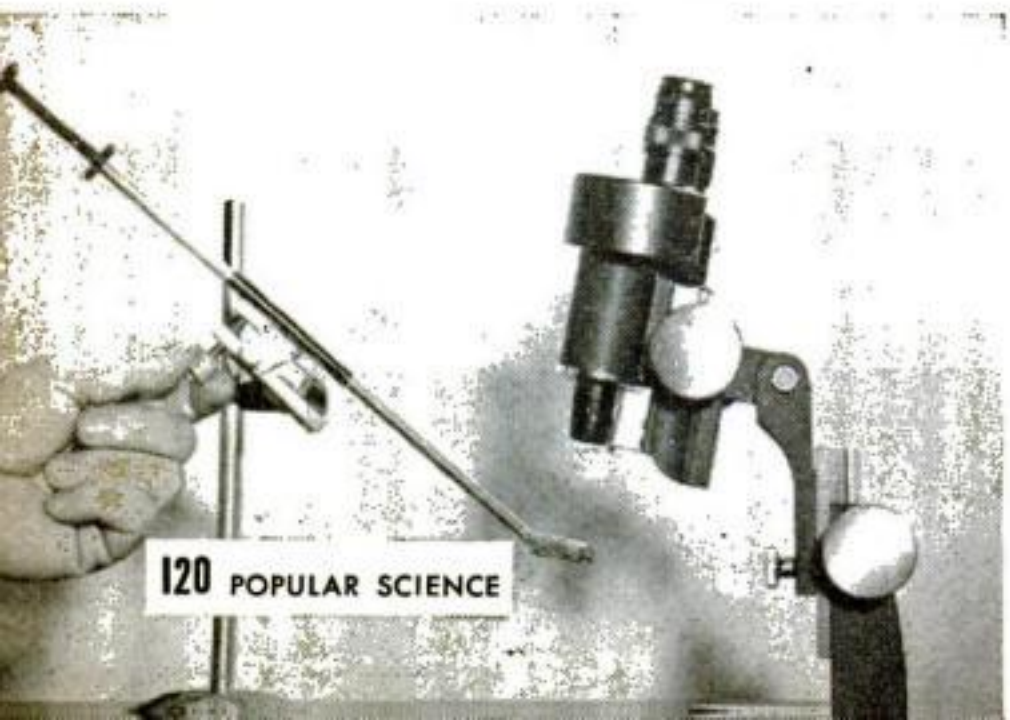
Called Visicam ®, it has a ground-glass viewer, 2 inches in diameter, on one end and a single-shot film holder on the other. Midway between them is a two-sided, angled mirror that reflects the microscope's image onto either the viewer or the film.

The operator simply focuses the image on the viewer, then rotates the mirror in the opposite direction to angle the image toward the film. A built-in shutter permits speeds from one to 1/100 of a second. The microscope's optical system serves as the lens.



Enlarged 1,000 times, microscopic sea plant appears on viewer just as it will on film. Dark spot contains cross hairs for sharp focusing. Black lines help operator center image on film.

Mechanical Finger Gives Microscope a Hand



THIS mechanical forefinger and thumb can do all your own can do—and do it better. Called the Harper Manipulator ®, it makes it easy for scientists to position minute, hard-to-hold objects under a microscope.

Tiny specimens are grasped between two small pinchers, opened and closed by a plunger. The arm itself can be moved in any direction and completely rotated. Two screws lock it in the desired positions.

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Truck Totes 74-Ton Shaft

RESEMBLING a huge cannon, a 74-ton rotor shaft for a new generator is shown being eased down a hill to the East Powerhouse of Grand Coulee Dam in Washington. The 32-foot shaft, brought across the top of the dam aboard this multiwheeled trailer truck, will be fitted with more than 500 tons of steel and copper to form the rotating part of man's largest hydroelectric generator. Nine similar units are now operating in the dam's West Powerhouse. Three of the new 108,000-hp. generators will be completed next year, three in 1950, three in 1951. Each will be driven by a 150,000-hp. turbine.

Fruit Goes By Trailer

GRAPE pickers in a 9,500-acre vineyard at Di Giorgio, Calif., now save time and steps by loading directly into these 6-ton hoppers. One problem in designing them was how to keep a train of four or more from cutting corners in turning out of tight rows. This was solved by connecting the two axles with crossed steering arms that turn the rear wheels in the same arc as the front wheels, like those of a hook-and-ladder truck. Thus each trailer in a train follows exactly the track of the tractor.

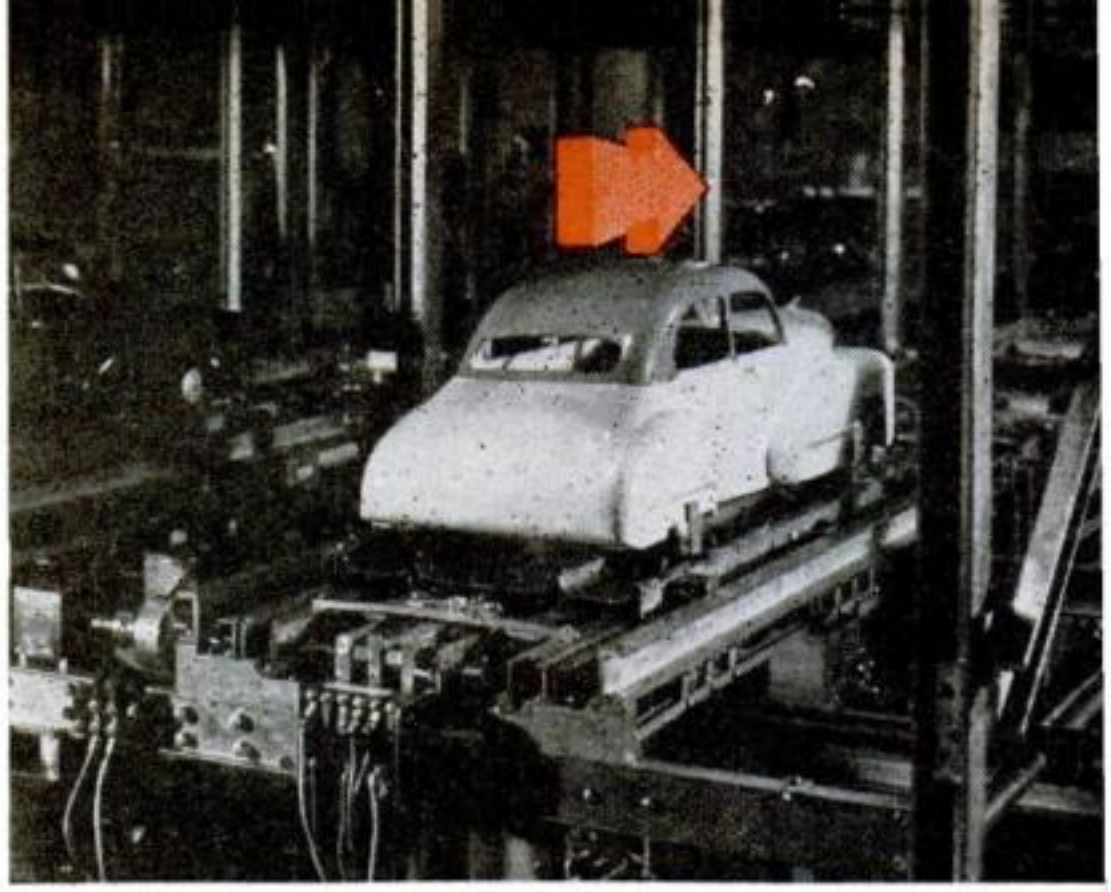




Coin in Slot Parks and Delivers Car

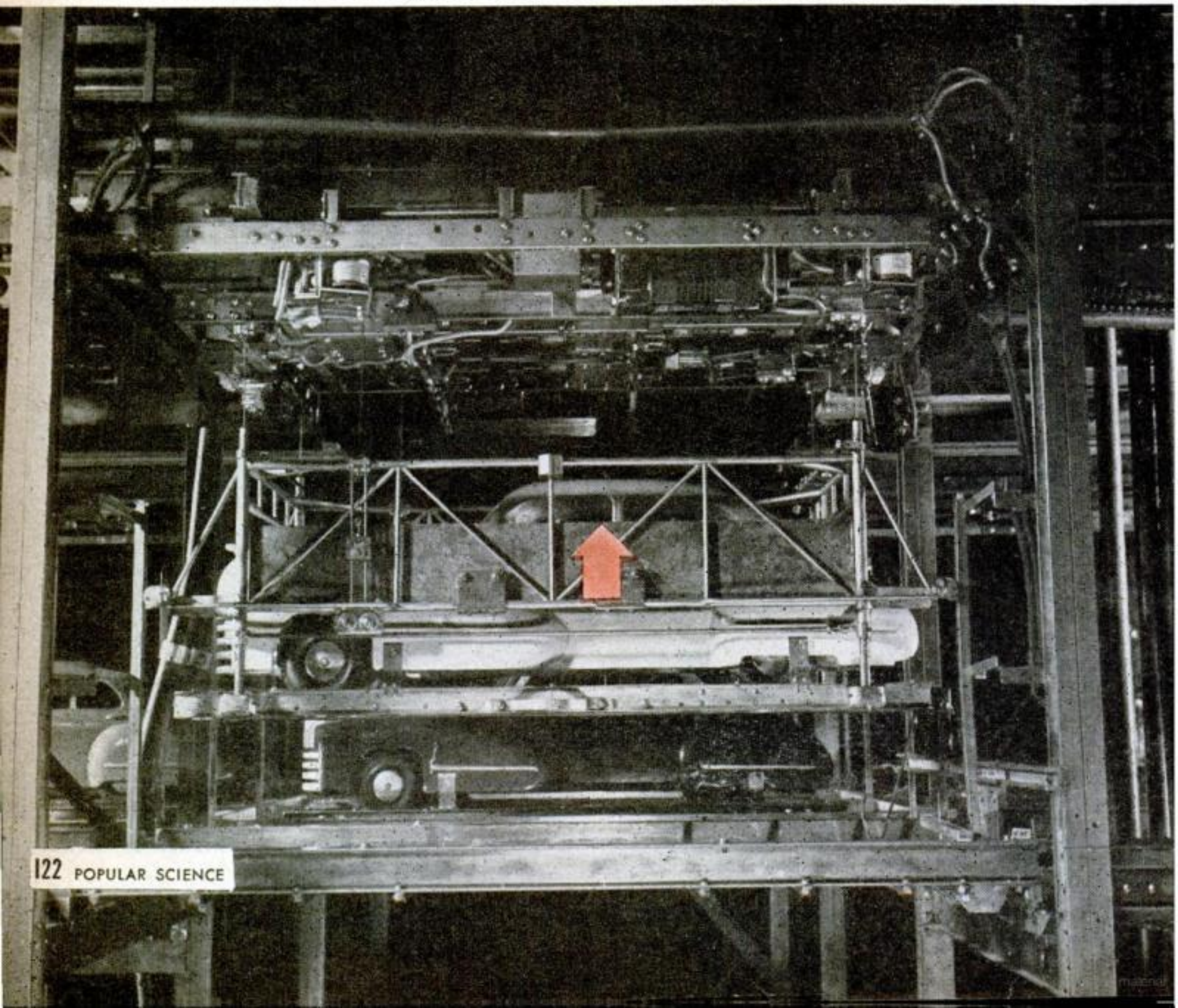
PS photos by Hubert Luckett

THIS scale model of a completely automatic parking garage shuffles cars the way a juke box files and picks out phonograph records. A New York real estate man, William Zeckendorf, developed it for efficient use of high-priced city land. Besides saving labor by operating at the drop of a coin in a slot, it saves space by having no ramps or unoccupied aisles. The model, built to a scale of one inch to the foot, is run by 34 airplane-control motors.



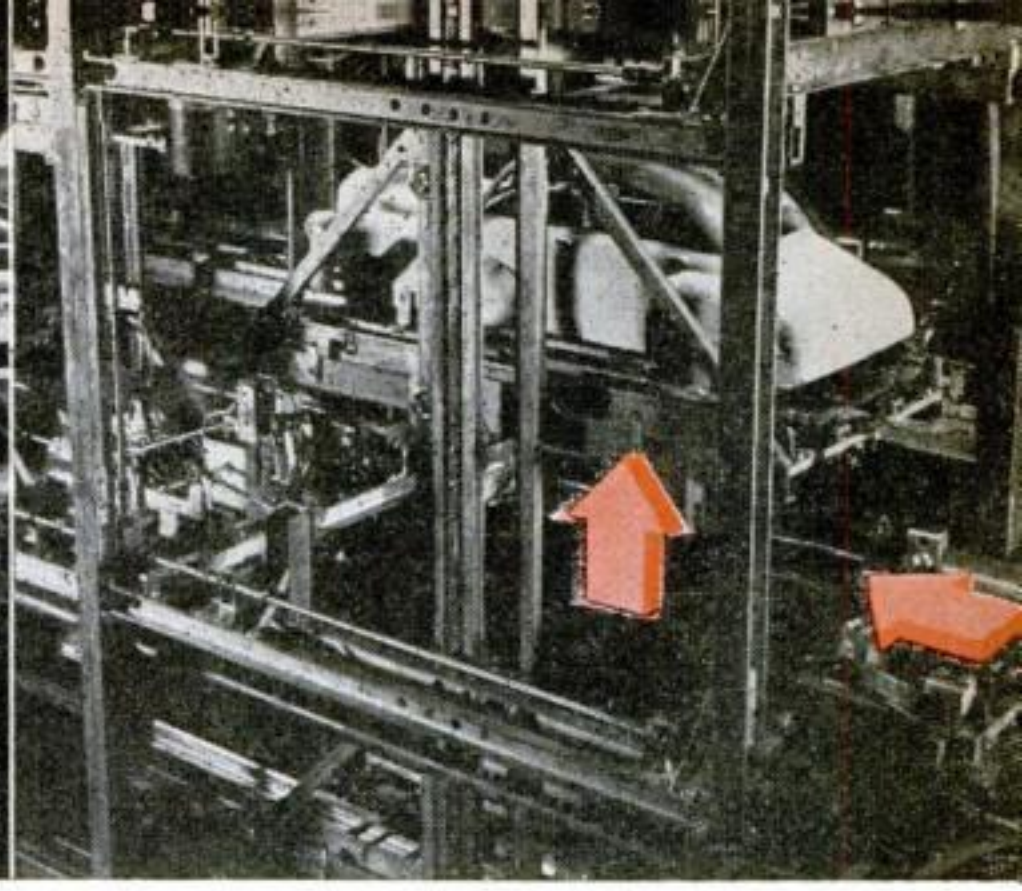
1 **At entrance station,** car is driven onto dolly on which it will rest all the time it is in the garage. Customer can set brake and lock door, because no one else will have to touch his car. Owner drops a coin in the slot and receives a token for reclaiming his car later.

4 **Horizontal conveyer** takes over to move car to its berth. An overhead crane drops a frame over car, picks up dolly, as shown below, and carries both over tops of other parked cars to vacant stall. There frame lowers car into stall, and automatically detaches itself from dolly. Crane then can pick up a car for delivery or return empty to the incoming elevator.



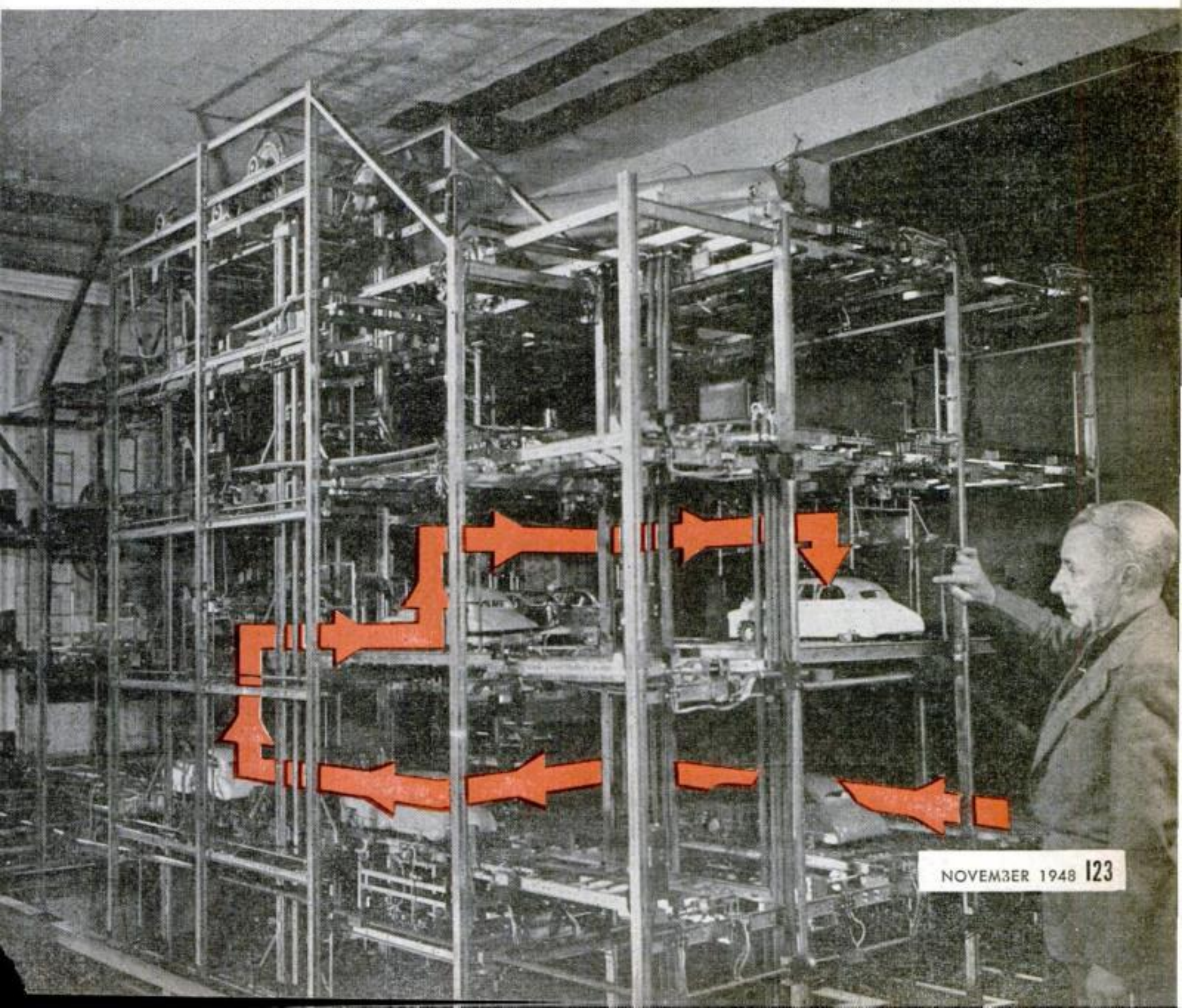


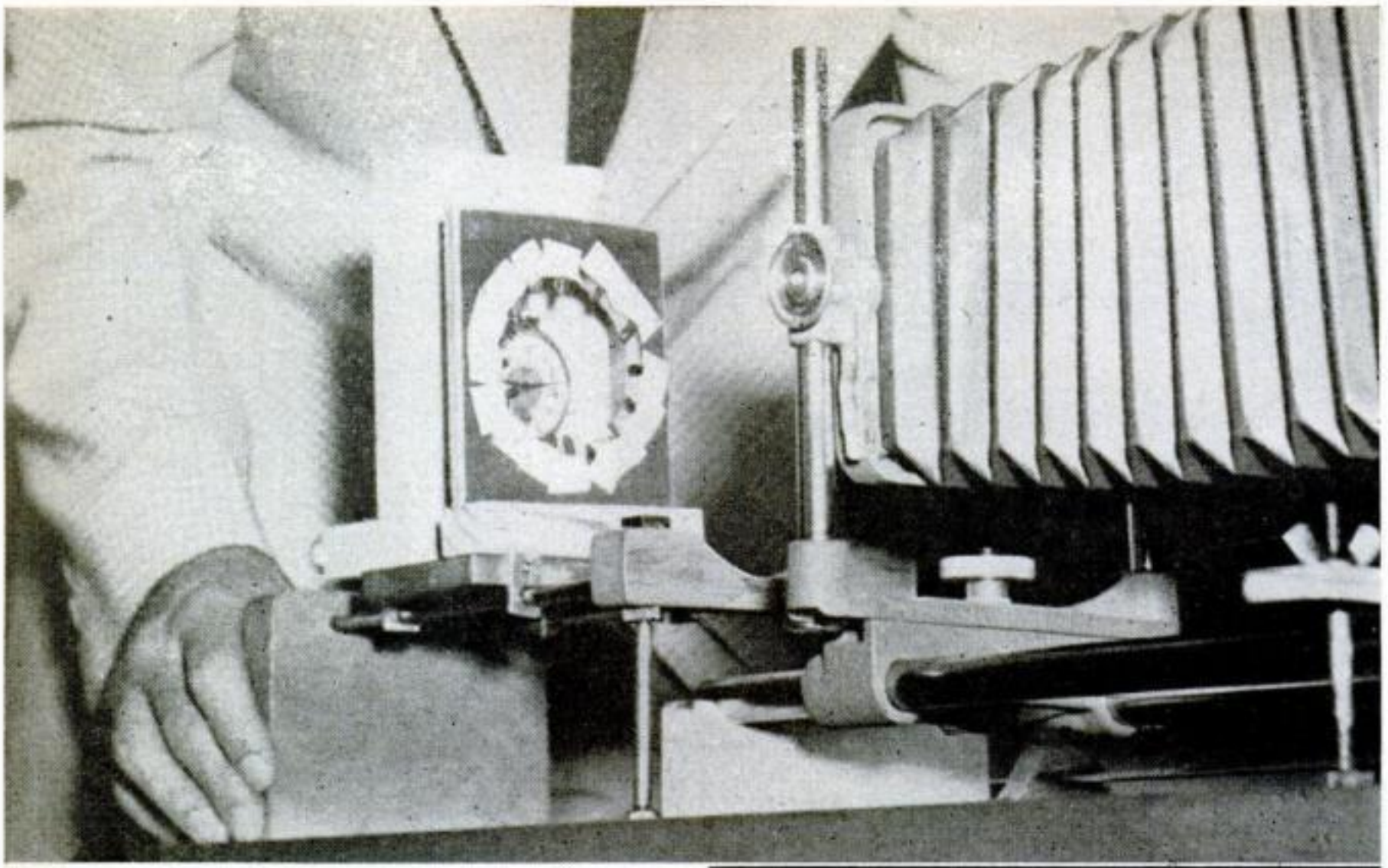
2 Car locked on dolly starts trip to automatically selected stall. Dolly is first brought forward to transverse conveyer. This carries it across garage, a few inches above floor level, to elevator. There the dolly is lowered onto rollers, pushed into an elevator, and locked safely.



3 The elevator, drawn up an open shaftway by an endless chain, hoists the car to its preassigned parking level. There automatic locks and leveling devices hold the elevator steady while a mechanical arm reaches out and pulls the dolly onto another roller platform.

5 Car's path from entrance station to parking stall is traced by red line on photo below. When customer calls for it, he simply drops token into slot at exit station. Same system of horizontal conveyers then brings car to door by way of exit elevator. Designers say a 10-level garage like this, on ground space 100 by 200 ft., could handle a total of 3,940 cars a day.





Battery of 15 fireflies is "focused" on watch to be photographed. Adhesive tape holds them to wooden ring, with their tails projecting over its inner rim, in front of studio camera.

Fireflies Light Photo

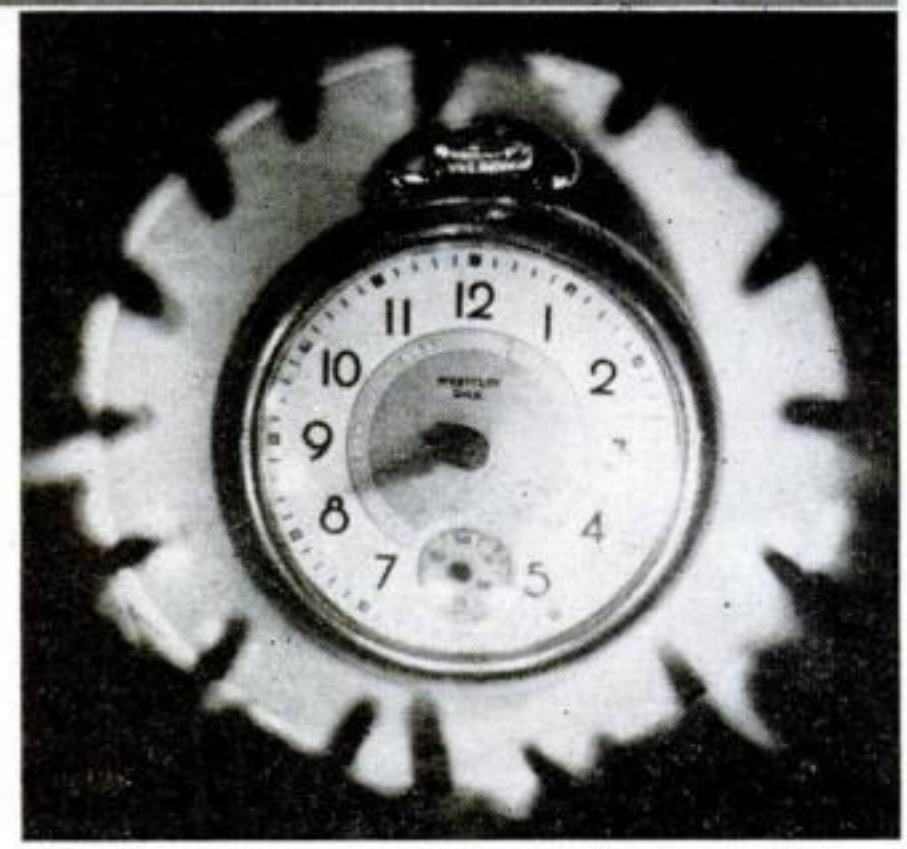
THOUGH makers of photo lamps probably need not worry yet about competition from fireflies, those little lantern-carrying beetles *can* be used as a substitute for flashbulbs in taking photographs.

This was demonstrated for the first time recently in the Mississippi State College photographic laboratory at State College, Miss. The setup and result are shown in the pictures above and at right.

The experiment left unanswered the question of how fireflies produce their light. All that's known is that a greenish glow somehow results when two substances in their tails, luciferin and luciferase, are combined with oxygen from air forced through a network of fine tubes.

Why fireflies light up is simple enough: their flash is a mating call. The male, flitting about, glows brilliantly, while the female sits demurely in the grass and flashes a faint response. Result: boy meets girl.

Males were used in the demonstration pictured here.



This is the picture taken by firefly light in a dark room. Hands of watch don't show because of their movement during hour-long exposure.



Firefly's tail light is an efficient lamp, for its size, since it emits none of the infrared or ultraviolet rays invisible to the human eye.

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British Outfly Sound

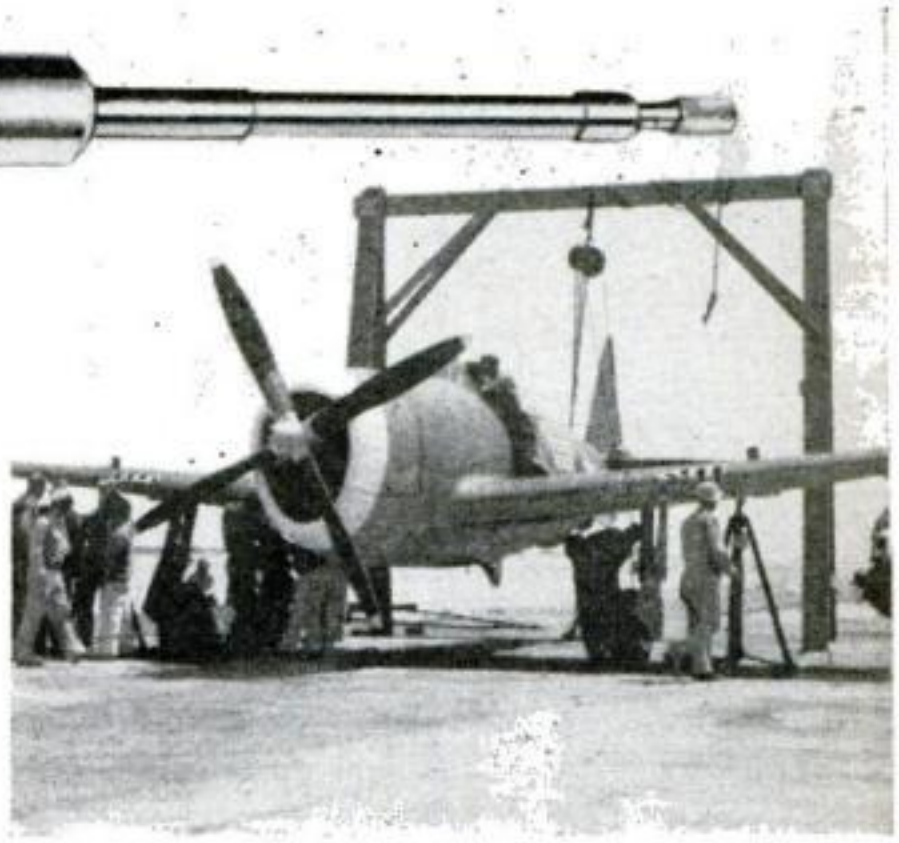
THE De Havilland 108 jet plane shown here recently flew faster than sound. The speed was not announced, but is believed to have been around 700 m.p.h. An experimental plane, like the U. S. Air Force's X-1, which has exceeded the speed of sound many times, the British sweptback Swallow differs in that it can take off under its own power. The X-1 (PS, Aug. '48, p. 96) must be launched at high altitude from a B-29.



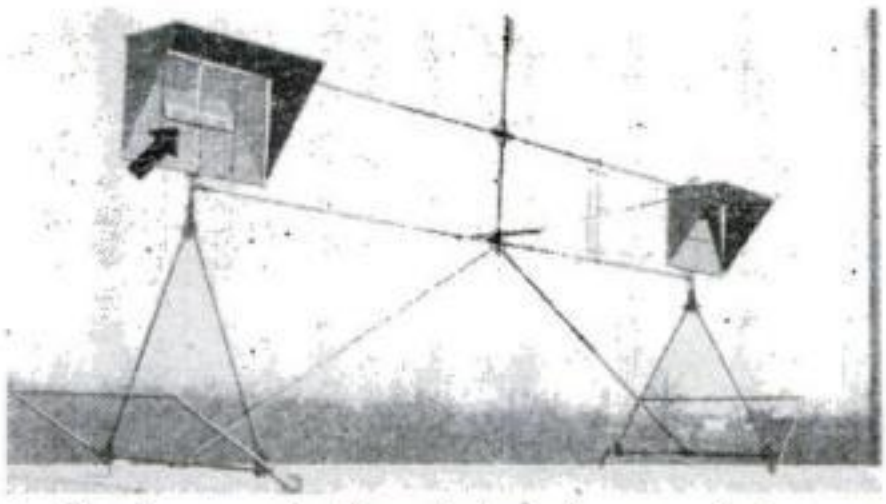


Arc Lamp Aims Guns

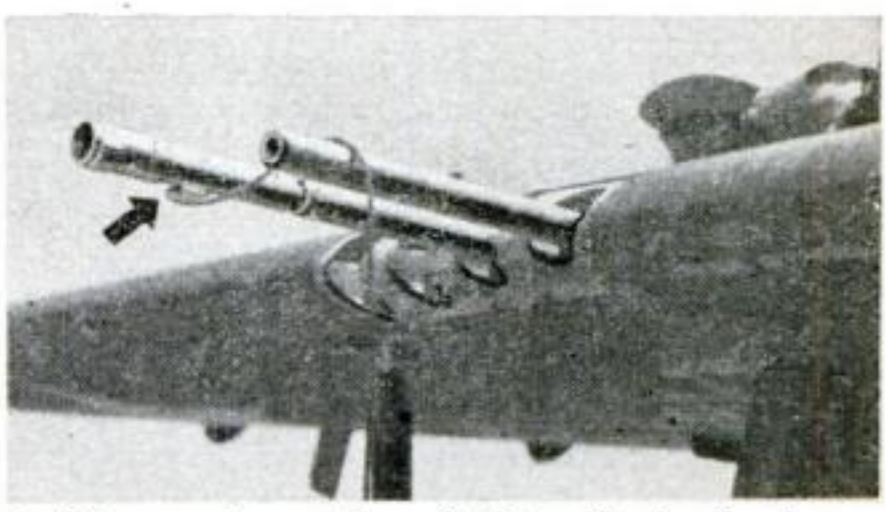
To make a kill, the multiple, wing-tip machine guns of fighter planes must be harmonized so that their bullets will concentrate on the aiming point—an enemy plane or ground installation. This adjustment, called "boresighting," can be done by using an optical device similar to a telescope, but inaccuracies result from human error due to parallax. To overcome this, a light-ray method of boresighting has been perfected, using the concentrated arc lamp developed by Western Union for communications during the war (PS, July '46, p. 98). The gadget that does it is illustrated above.



1. Tail and wing jacks are used to level an F-47 Thunderbolt to the "attitude" it would assume while speeding at 300 m.p.h. Its .50-cal. guns are aimed at a correcting target.



2. Background of each target, mounted on a lightweight, collapsible framework, is covered with Scotchlite ®, a highly reflecting material. Arrow indicates four red-button aiming points.



3. The arc-lamp boresighting device is shown at left, above, inserted in the muzzle of a machine gun. When the projected light beam hits proper red spot on target, the gun is aligned.

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Life-Saving Lightning Born in Back-Yard Lab



In heavy storms and pea-soup fogs, this new, 2/3-mile-long lighting system at Idlewild Airport flashes a brilliant pointer 1,000 feet in the air to help guide blinded pilots safely in.

A modern Zeus hurls miniature lightning bolts to mark the sky road to safety for fog-bound fliers.

By George H. Waltz, Jr.

BRILLIANT flashes of man-made lightning, born in a back-yard garage, are now guiding planes to safe landings at America's foggiest airport.

Produced by a row of cigarette-size lamps, the boltlike streaks of light pierce the soupiest weather to lead planes to the landing strip at California's Landing Aids Experiment Station near Arcata. Soon they will be assisting giant air liners into New York's International Airport at Idlewild.

Designed to help take the blindness out of blind landings, the new all-weather approach system—a Westinghouse development—uses 35 of the world's brightest lights and 34 neon lamps. Arranged alternately in a long line stretching out from the end of a runway, the 69 lamps flash on and off in rapid succession to form a vivid ribbon of light that is visible at 1,000 feet through zero-zero fog.

Viewed from the air, the lights start appearing near the inner radio marker to which pilots are guided by the airport's instrument landing system (ILS). From that marker they dart, like a guiding finger, toward the beginning of the runway. Once over the radio marker, pilots simply follow the lightninglike streaks into a landing.

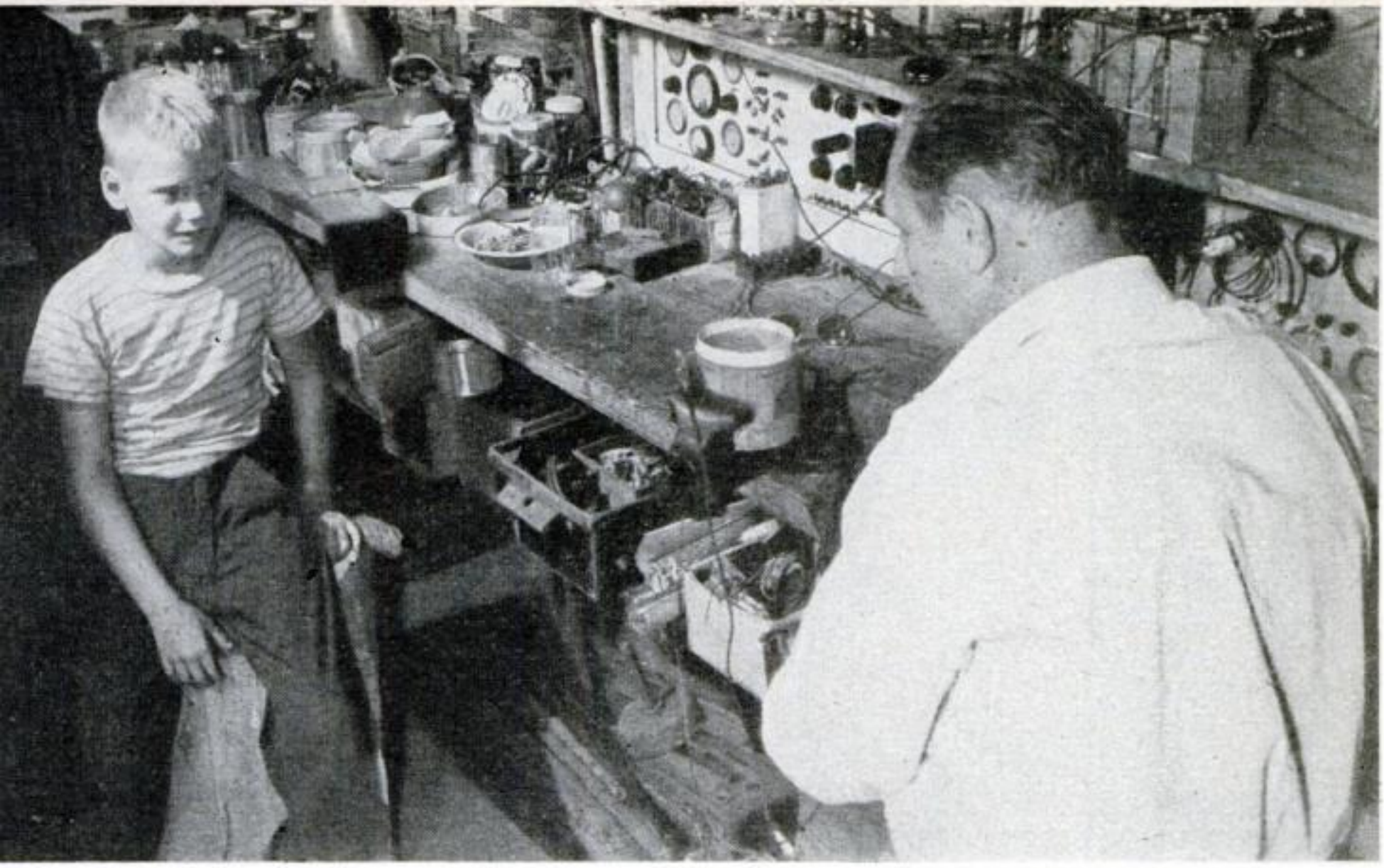
The new lighting system itself is an important news item (PS, July '47, p. 133). But the dramatic story behind its development is even more intriguing, particularly to the home experimenter.

Four things made the new all-weather approach lighting system possible: a new brilliant light called the krypton lamp, the stubborn curiosity of a scientist, a garage laboratory behind the scientist's home, and the cooperation of his family, friends, and the neighborhood kids.

During the war, Bill Pennow, a Westinghouse researcher in Cleveland, spent his normal working hours thinking up new and better searchlights for the Navy. As his experimental work with light beams progressed, he became fascinated with the problems of sending light through dense fog. He wondered just what kind of light was needed to pierce the heaviest weather.

Working with pencil, paper, and slide rule during his spare time, Pennow rooted

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In his garage laboratory. Westinghouse's Bill Pennow worked stubbornly to discover the new lighting system. Neighborhood kids were willing guinea pigs in tedious eye-reaction tests.

out some of the mathematical answers to the problem. First of all, he decided that to punch light through the kind of ground fog that ties up airports he would need something like 1,000 times more light than was obtainable from any lamp commercially available at that time. He also decided that what he needed was not just light, but *lightning*.

Bill Pennow found his lightning source in a special super-light developed by Westinghouse research engineers, during the war, for night aerial photography. The lamp's slender quartz tube is filled with krypton, one of nature's rarest gases. When a surge of high-voltage electricity from a miniature artificial-lightning generator is discharged through the gas, the lamp flashes with a brilliance of 9,000,000 candlepower per square inch—nine times greater than that of the sun! It literally produces a flash of man-made lightning lasting 17 millionths of a second, or about 1/10 as long as a flash of nature's lightning.

Pennow was confident that the krypton lamp's flash would penetrate the thickest fog. His next problem was to find out what effect such a powerful light might have on a pilot's eyes. Would the brilliant flashes blind him? Or would they help him to grope his way down through heavy weather?

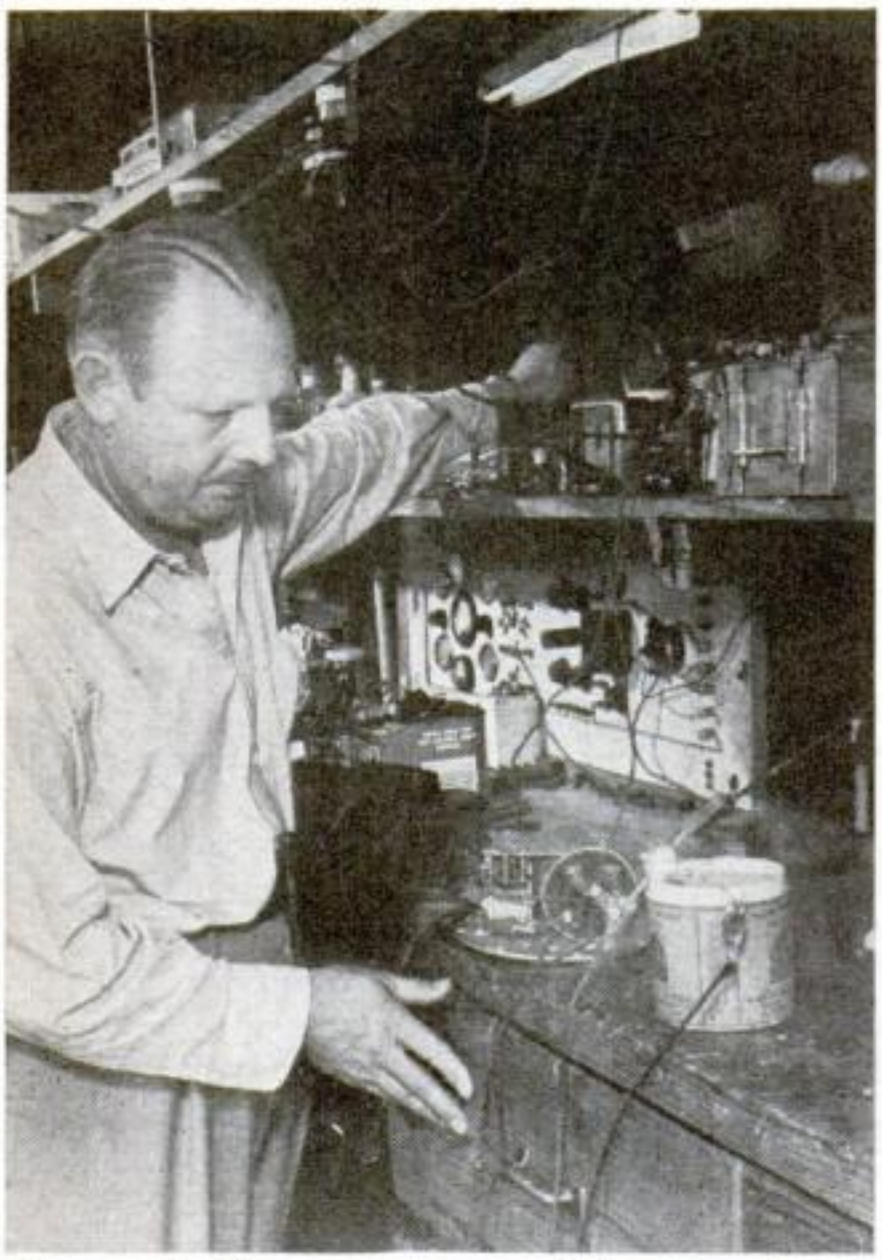
Text books and the reports of earlier experiments proved of little help. Most material on the subject was vague. No one had ever thoroughly investigated the physiological effects on the human eye of short changes in light intensity.

Bill took that problem out to his private two-car garage in back of his house. Garden tools, old tires, and odds and ends of stored furniture were cleared out to make way for homemade laboratory gear. He set up various types of flashing lights. He installed optical test instruments and sensitive recording equipment.

For his human guinea pigs he called on his family and his friends and rounded up the neighborhood youngsters. Few visitors to the Pennow home during those days escaped without a visit to the Pennow garage-laboratory to have their eyes checked against the effects of Bill's flashing lights. More than one local teen-ager gave up some of his play time to look at a flashing light while Bill Pennow slowly increased the length of the flashes until the youngster blinked.

Working with his homemade equipment

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Heart of lighting system is krypton lamp. Here Pennow works on one of the original models. Lamp's flash lasts only 17 millionths of a second, is nine times brighter than sun.



Lamp's reflector is biggest part of unit. Krypton lamp itself, scarcely visible in the center, is only four inches long and no thicker than a fountain pen. The system uses 35 such units.

in his back-yard laboratory, Pennow learned some amazing things. He found that no light can flash fast enough to avoid detection by the human eye. Even light pulses as short as a millionth of a second are perceptible.

But more important, he discovered that when eyes are adapted to darkness—as a pilot's are at night—the iris refuses to respond to any change in light intensity shorter than 1/1,000 of a second. In other words, he found that the normal eye can look at the most brilliant flash of light without the iris shutter closing or the eye being harmed—if the flash is brief enough.

Out of these home-laboratory experiments grew the combination of krypton plus neon lamps for the new Westinghouse approach-lighting system.

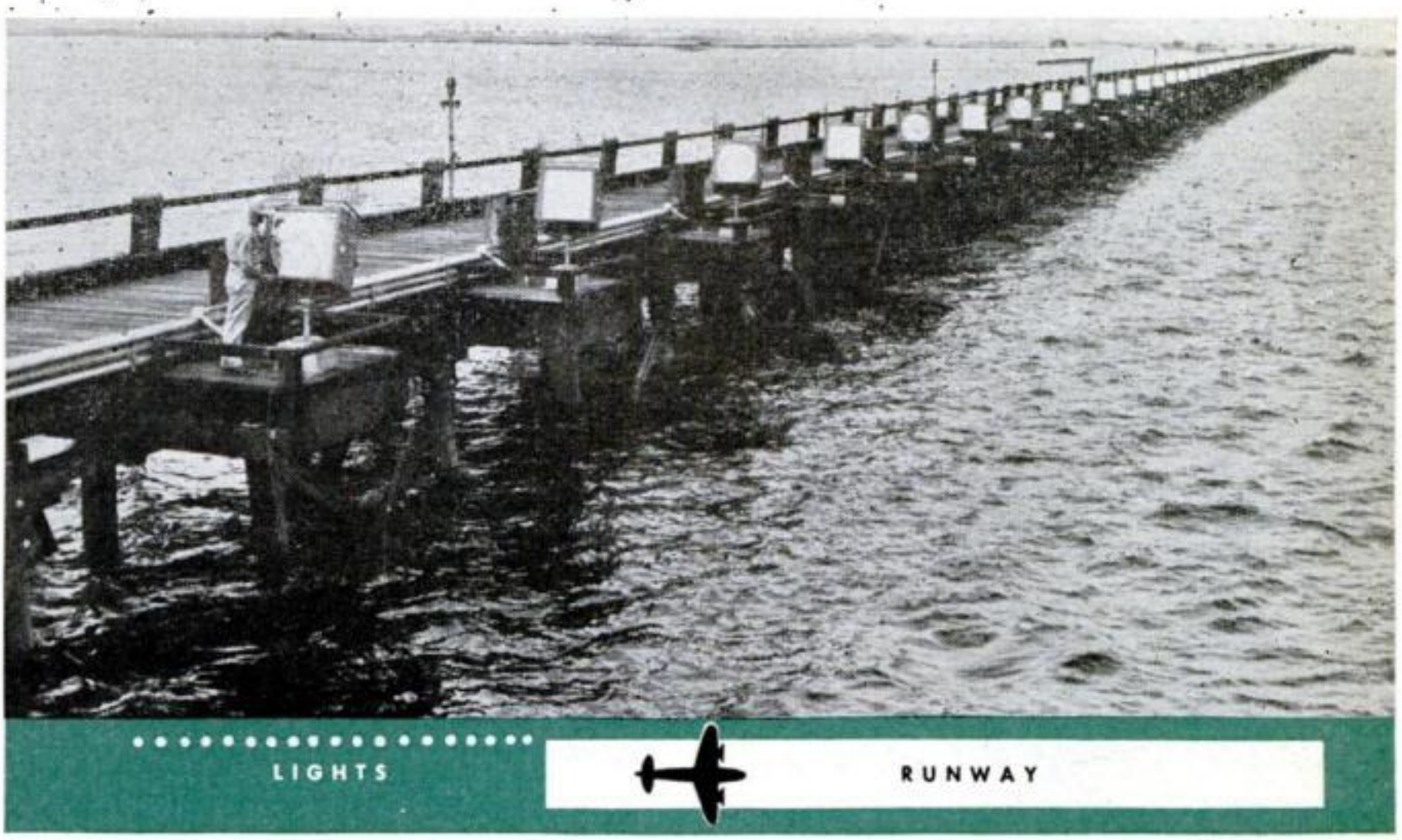
A little over a year and a half ago, Pennow was able to put a condensed version of the new lighting system to extended tests. He and his fellow engineers installed a six-light unit along the approach to one of the runways at Cleveland's Municipal Airport. On more than one occasion since, the short lightninglike streaks made by this experimental installation have saved lives by guiding fog-bound fliers to safe landings.

At Arcata—a spot plagued by the worst fogs in the country—a full-size version of the approach-lighting system is now getting a thorough testing under the toughest conditions.

Mounted in special reflectors, each of the 35 krypton lamps in the system can give off a flash of 3 1/3 billion beam candle-power—equivalent, during its brief interval, to the light from 50 million 60-watt household bulbs and brighter than the brightest searchlight ever built. Arranged alternately with the 34 "blaze" neon lamps in a long line extending out from the end of the runway for two-thirds of a mile and fired in rapid succession 40 times a minute, the lamps create a brilliant animated pointer.

The krypton lamps are flashed at their full power only during conditions of zero-zero visibility. When the fog is light and there are no low clouds, so much man-made lightning would be wasteful and a nuisance. In clear weather, the krypton lamps can be stepped down in brilliance to as low as 1/3,300 of their full flashing power. Or

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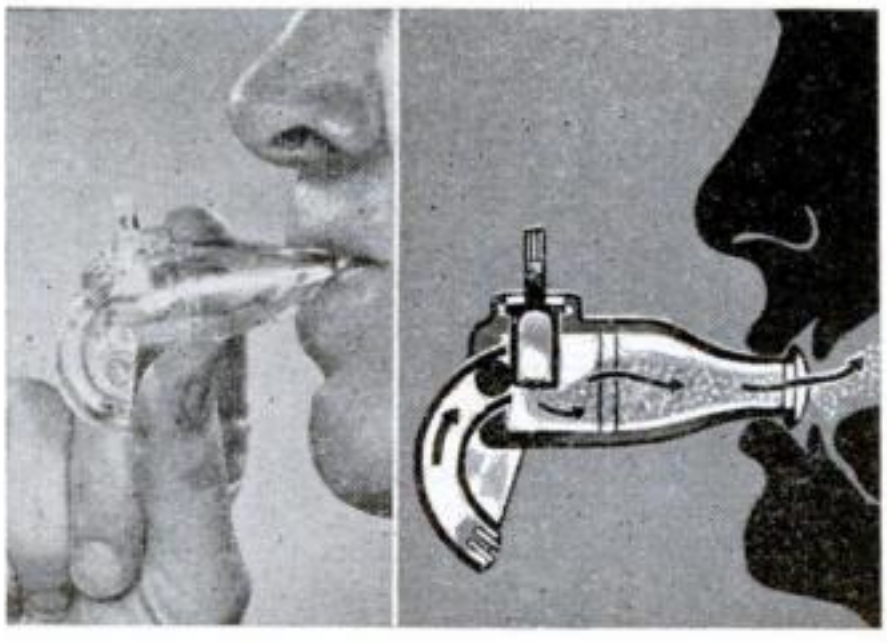


The 35 krypton lamps, alternating with 34 neon "blaze" lamps, are mounted on a 2/3-mile-long pier stretching out into the water at the Idlewild Airport. Spikes on top of the box-like lamp housings help keep birds away. Sketch shows how ribbon of lights, which flash on and off in rapid succession, leads storm-blinded pilots right to beginning of runway.

they can be turned off completely in favor of the less brilliant neon units, which can be used as flashing or steady-burning lights.

Not long ago, an Air Force C-54 transport plane developed engine trouble near Cleveland. The pilot, in touch with the Cleveland airport by radio, received the grim news that the ceiling there was little more than 300 feet. Nevertheless, he decided to attempt a landing. After three unsuccessful attempts to find the field, the pilot was on the verge of turning away to risk a search for better weather when the airport personnel turned on the field's instrument landing system and the Westinghouse experimental lights.

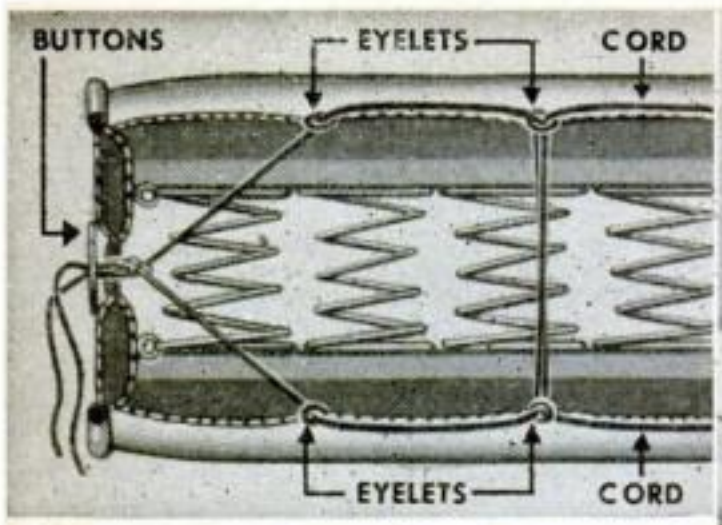
On his next try, the pilot followed the ILS signals toward the airport and then picked up the flashes of the six brilliant lights. Safely on the ground with his crew of seven and 32 passengers, he told observers that he "never would have made it" if it hadn't been for Bill Pennow's man-made lightning. END



Inhalator Kills Germs

You can inhale penicillin just as easily as pipe smoke with this clear-plastic Aero-halor ®. Inhaling, as diagrammed at left, forces a tiny metal ball up a curved track until it strikes a sifter container filled with the powdered drug. This jars a small amount of the powder out of the sifter, and the air stream carries it into the nose, throat and lungs. Made by Abbott Laboratories for treatment of these areas, the inhalator has interchangeable nose- and mouthpieces.

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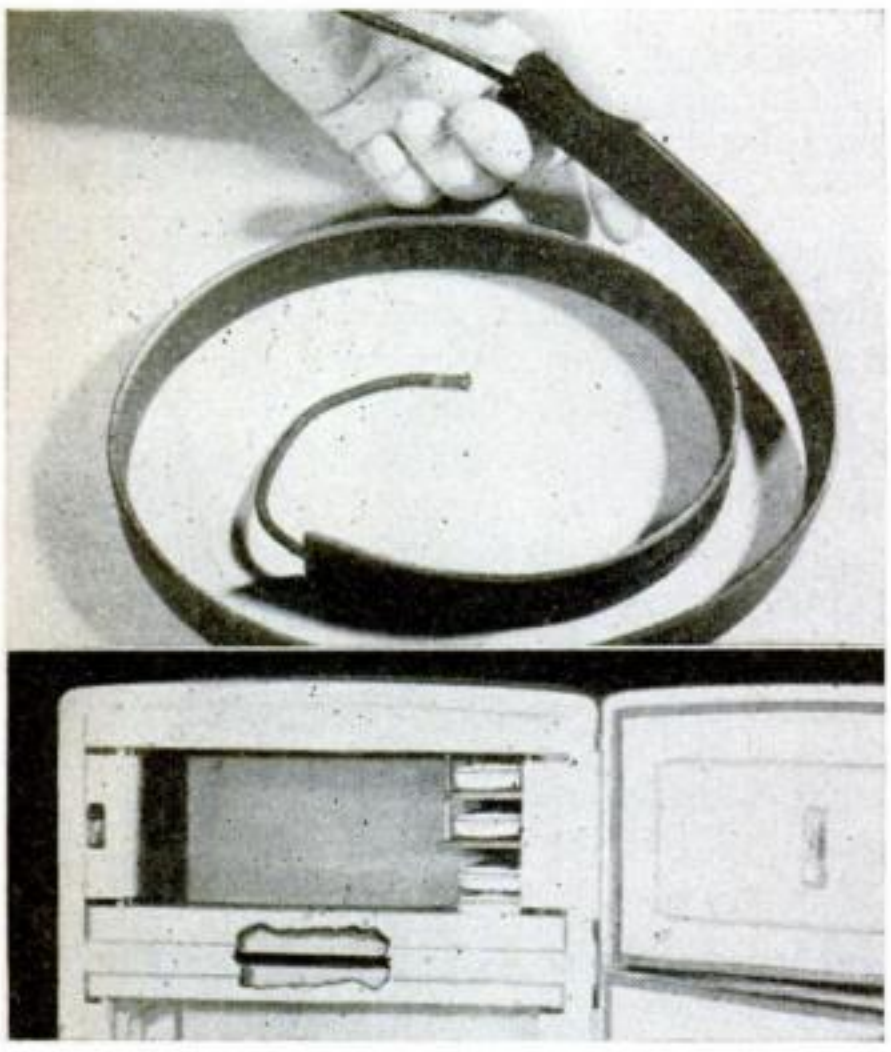
Cords, strung through eyelets in top and bottom of spring casing, are led out of mattress through large buttons, indicated by arrows at right. At desired tension, cords are wound around buttons to hold them tight.



Adjustable Mattress Tailors Bed to Sleeper

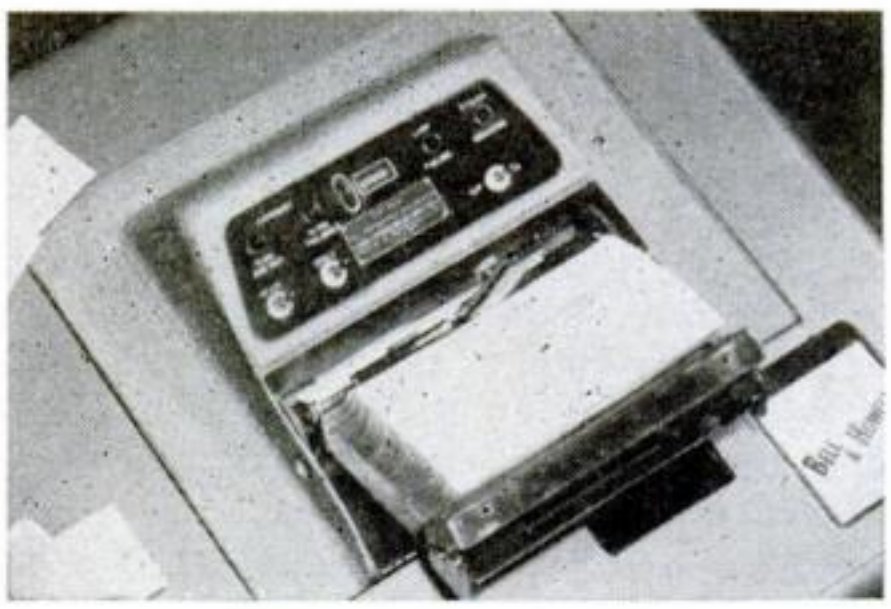
IF YOU like your half of the bed hard while your wife likes her side soft, you can both have your way with this new Sleep Selector ® mattress. And if you like the head of the mattress firmer than the foot, or vice versa, you can arrange that, too.

Each half of the mattress has two sets of cords, one near the head and the other the foot, running through the spring casing and leading out openings in the side. Tightening the cords compresses the springs, increasing the firmness in each area as desired.



Freezer Gets Heater

TO KEEP refrigerators from "sweating," U. S. Rubber has developed a heater that keeps the outside warm enough to prevent condensation without affecting the temperature inside. Simply a strip of electrically conducting rubber (top photo), it serves as a resistance element without wires. The cutaway (bottom photo) shows it installed.



It's Done with Mirrors

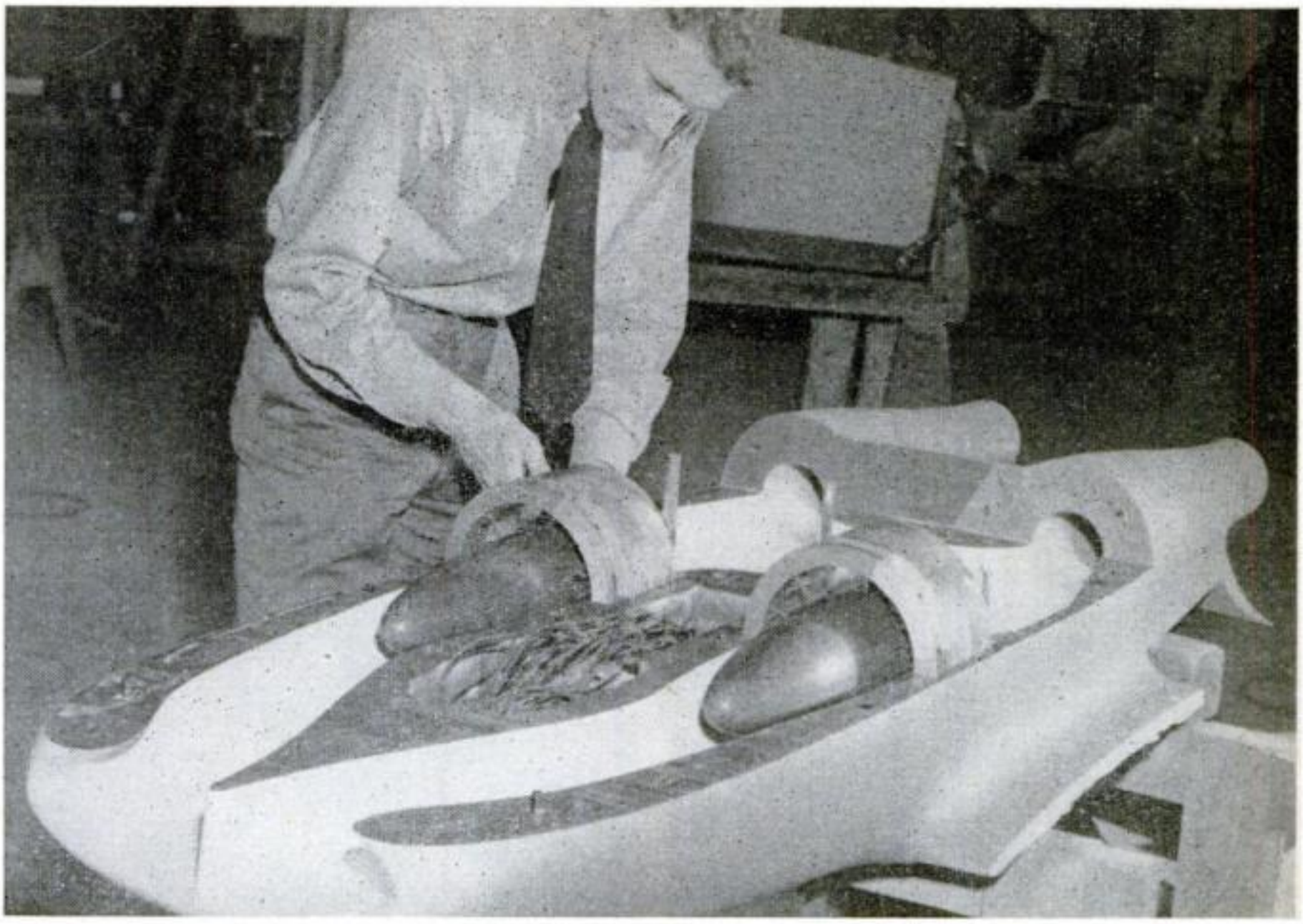
A SYSTEM of mirrors lets this new Bell and Howell microfilm recorder photograph both sides of a document at once, placing them side by side on 16-mm. film. An automatic feeder runs 250 documents through a minute—twice as fast as in present recorders.

Nut Locks on Screw



IF YOU can't reach behind a panel to put on a nut, just push through a Snap Nut ®. Screws, No. 8 or 10, spread it apart, locking both screw and nut in place.

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This large, precision test model of a twin-jet nacelle may point way to bombers of the future.

Aero Lab Is Craftsman's Dream

ON THE tidal flatlands south of San Francisco is a laboratory equipped like a workshopper's heaven. Here, wood and metal are worked with a precision that even a watchmaker would consider finicky. Here, the craftsman is king.

The Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics, at Moffett Field, Calif., has the tools to do this kind of work. It has to have. For this laboratory creates model airplanes and parts for the delicate tests that tell engineers how real planes—long before they are ever built—will perform.

The models, accurately scaled with precise skill, are put into wind tunnels and battered with man-made hurricanes of speeds from a few hundred miles an hour to those far beyond that of sound. Some of the designs tested will never get off the ground. Others, surviving the smash of repeated trials, will turn up in airplanes in the months and years to come.

Many kinds of materials are used in the Ames model-building laboratory-workshop. The pin-point noses of fuselages are sometimes made of plastic. Wings are occasionally machined from solid steel. Tough Central American mahogany is an old shop stand-by. Often wood, easily contoured, is built around a steel framework for strength.

The laboratory's super-workshoppers meet problems that the average model maker never encounters. Yards and yards of tiny copper tubing, for instance, must be embedded in the models to record vital airflow information. Wing edges must be ground razor-sharp to explore the mysteries of supersonic flight. To come as close as possible to the real thing, some models are built large—only a few times smaller than the huge, full-scale planes they represent.

On the following pages is pictured the birth in model form of an engine nacelle for a new jet bomber—from its conception in clay to its wind-tunnel baptism.

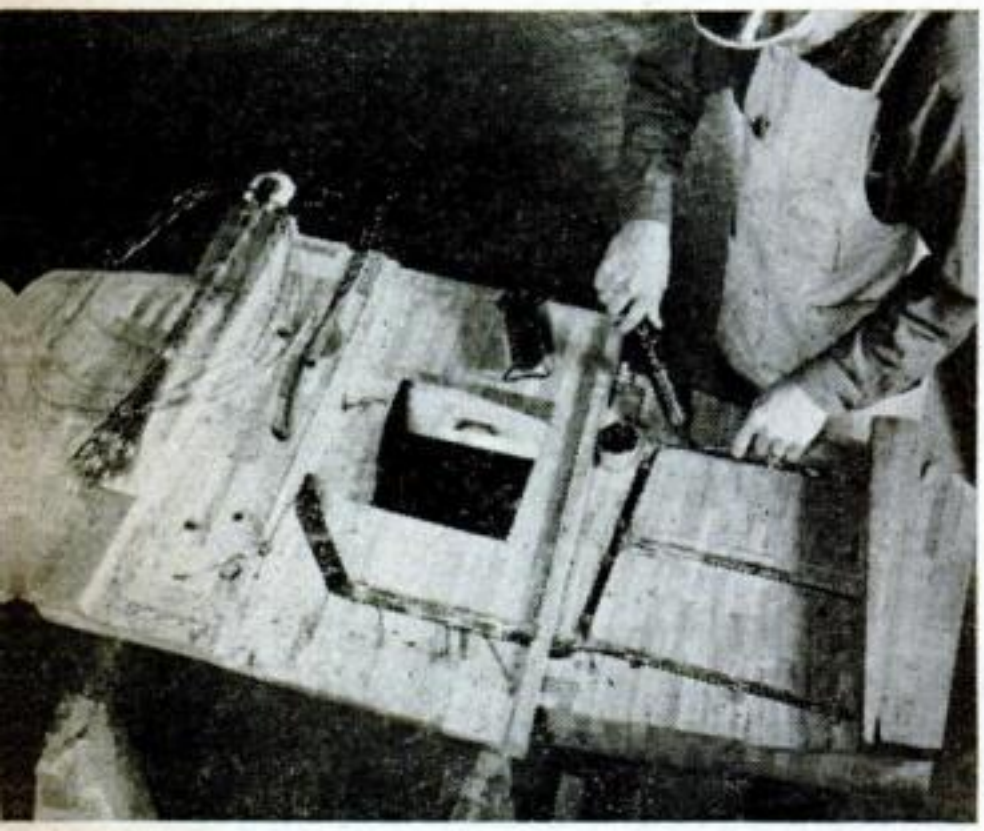
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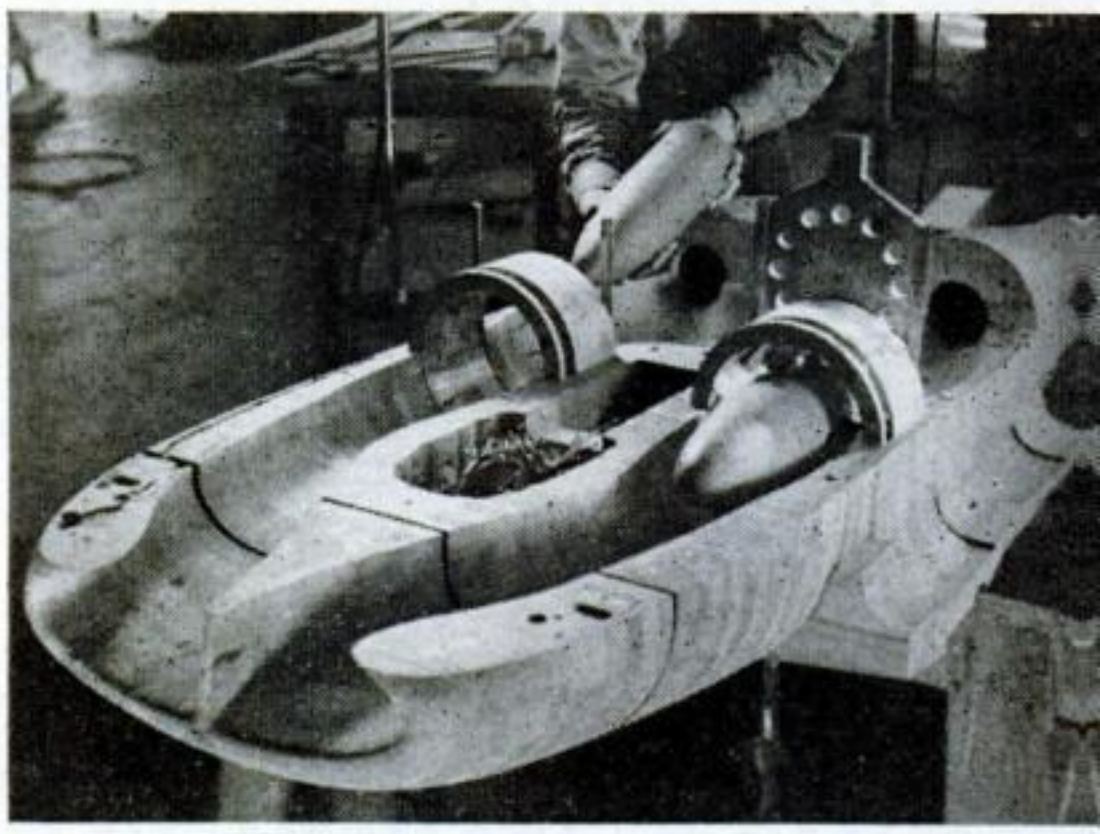
Design of new bomber begins with test model of one of its twin-jet nacelles. Here templates are checked with vernier gauge. Accurate to .002 inch, they will guide shaping of model.



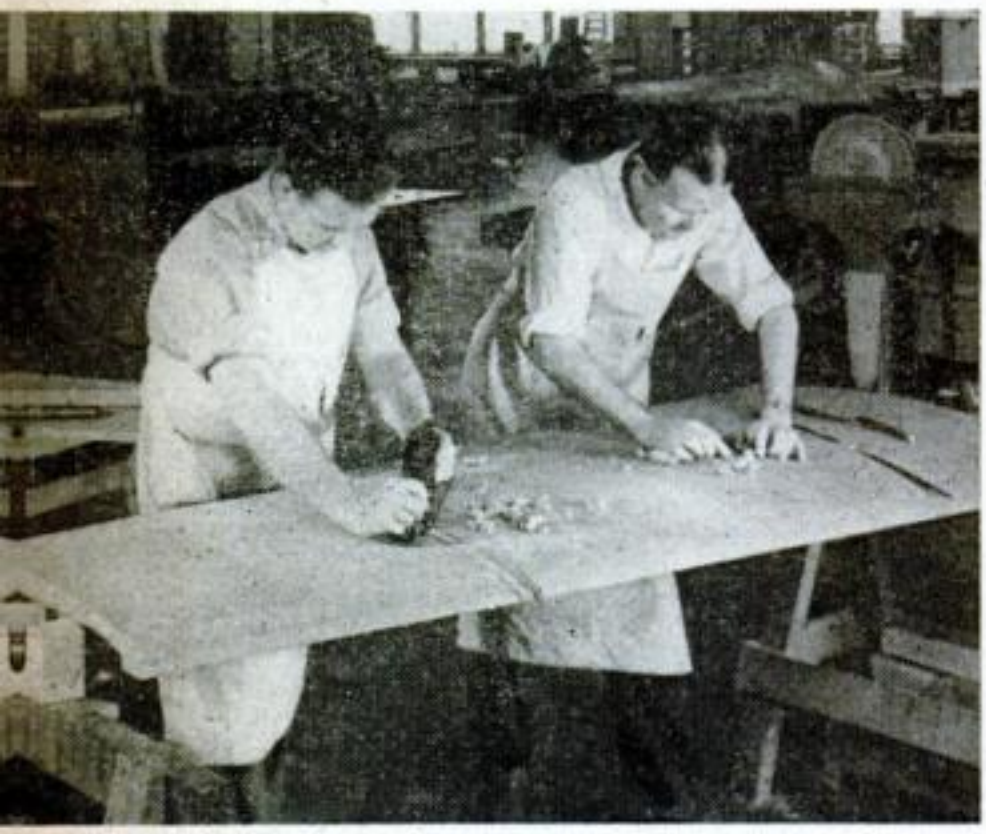
Finishing touches are put on preliminary clay mockup of nacelle from which larger, wood-and-metal model is made. Nacelle will be tested by itself and as part of complete model bomber.



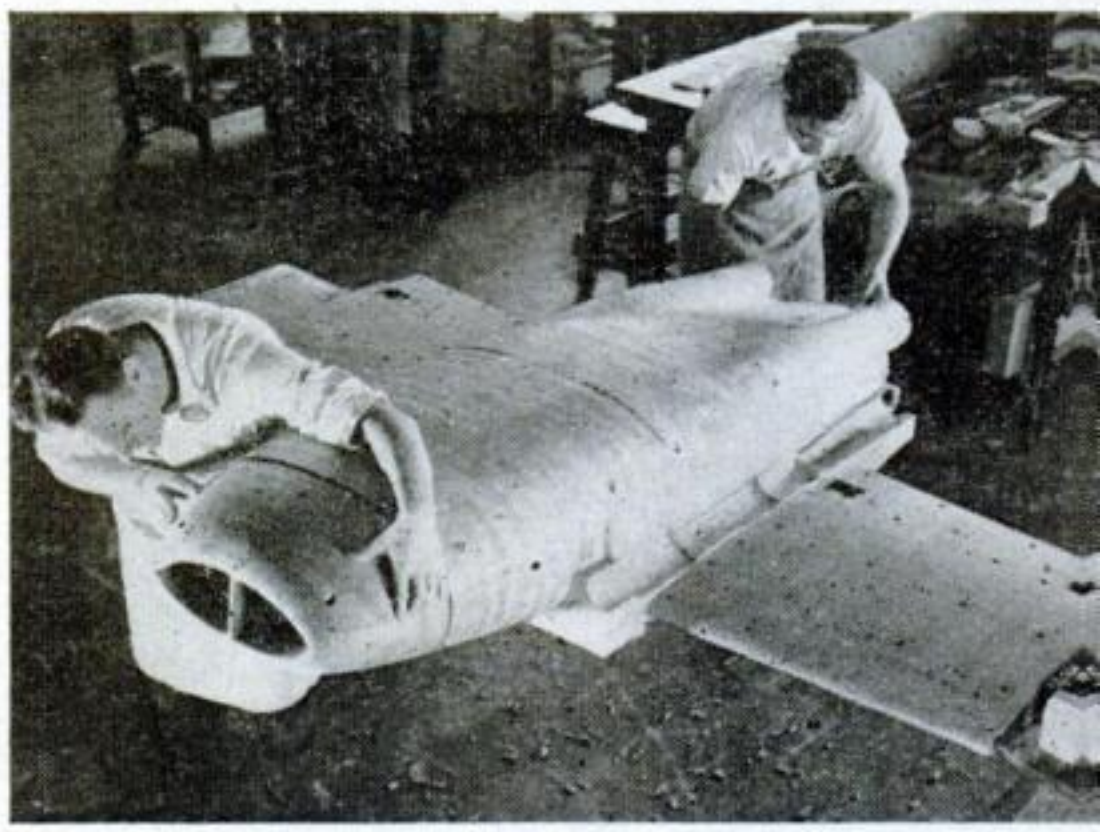
Nacelle's underside is maze of pressure tubes. Each one must be soldered in place to keep it from jarring loose. Tubes lead out of model through wing to manometers outside tunnel.



Inside nacelle, bulletlike objects representing parts of twin jet engines are installed in jet tubes to simulate internal air-flow conditions. Nacelle model is about one-fifth actual size.



After wing is shaped by router, rough spots are planed smooth by hand. Delicate sanding completes the job. Such wood-and-steel models are stronger and more accurate than real wings.

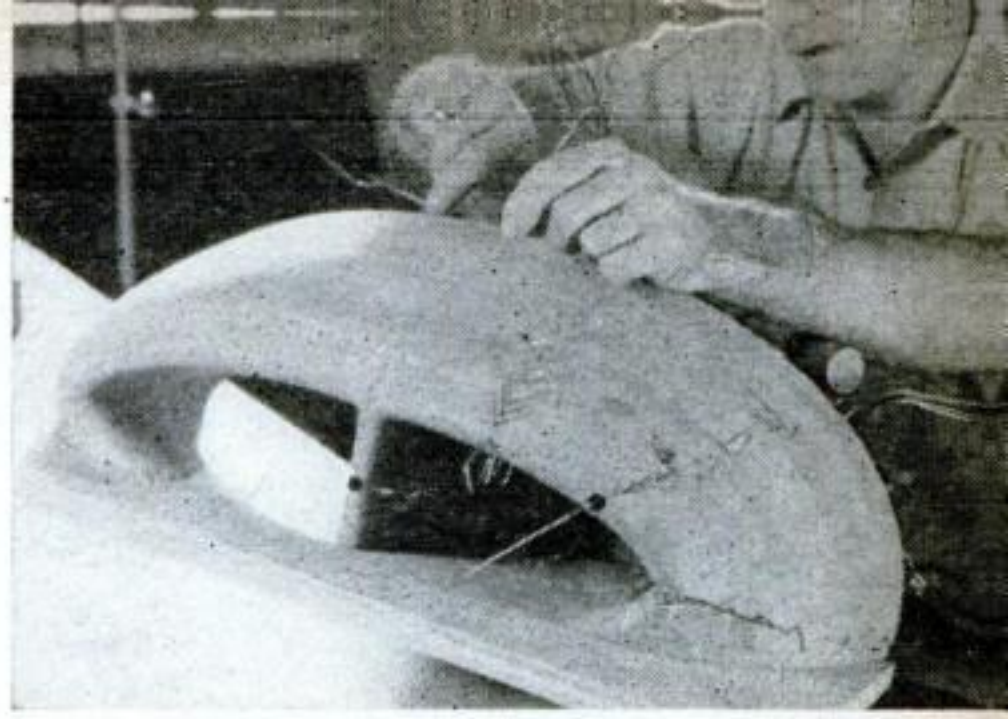


Nacelle body, made in several sections, is assembled and then fitted to one-piece wing section. Fillets between wing and nacelle are hand-carved and sanded to make smooth fairing.

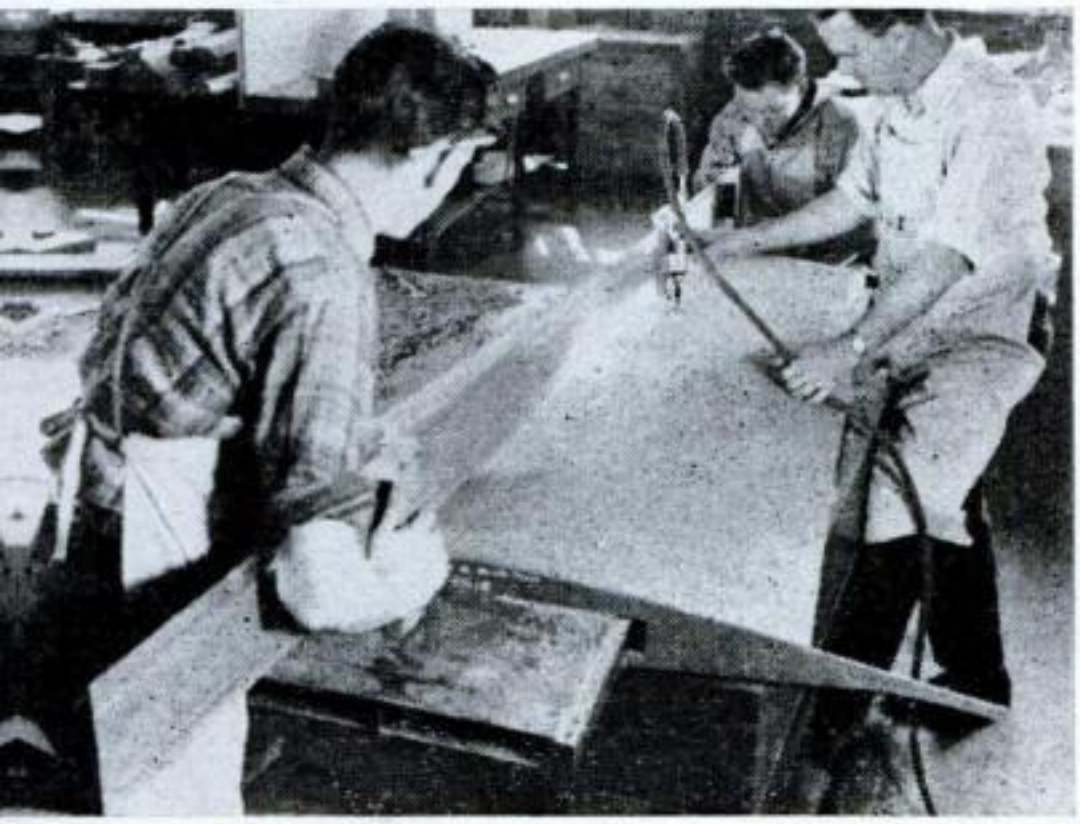
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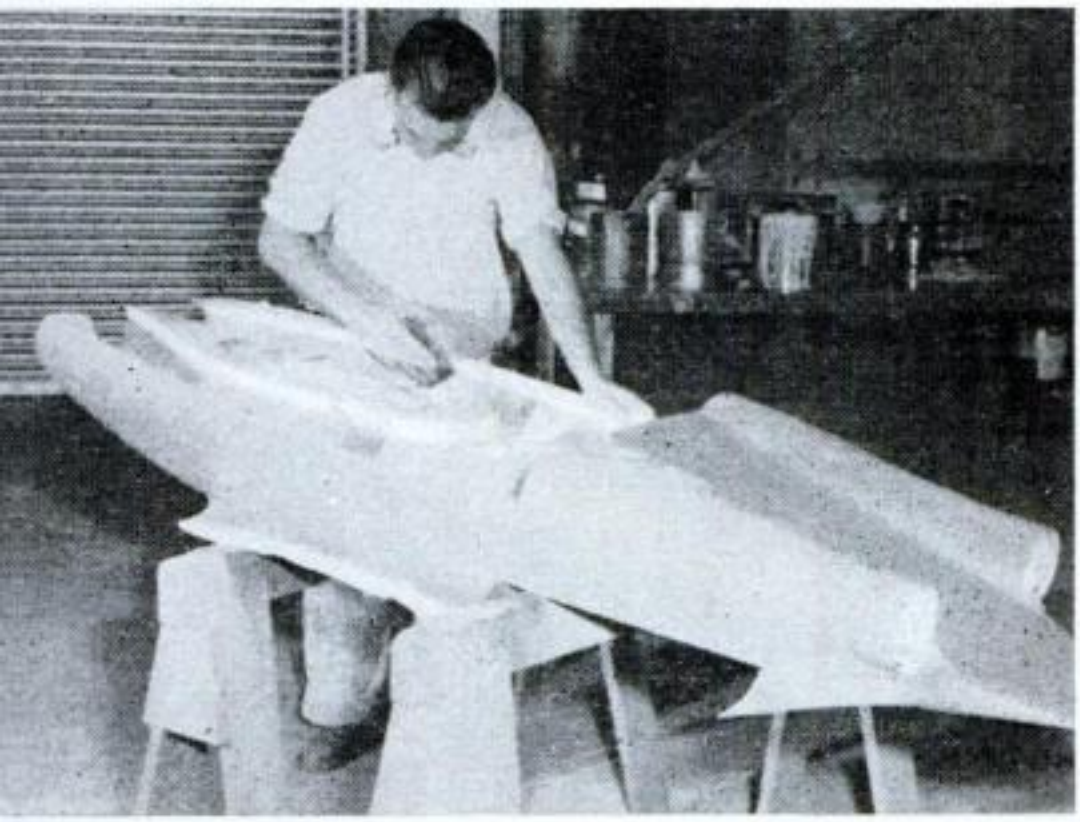
Nacelle body is built up of sections of tough Honduras mahogany, combining structural strength with ease of shaping. Sections are contoured with templates and then glued.



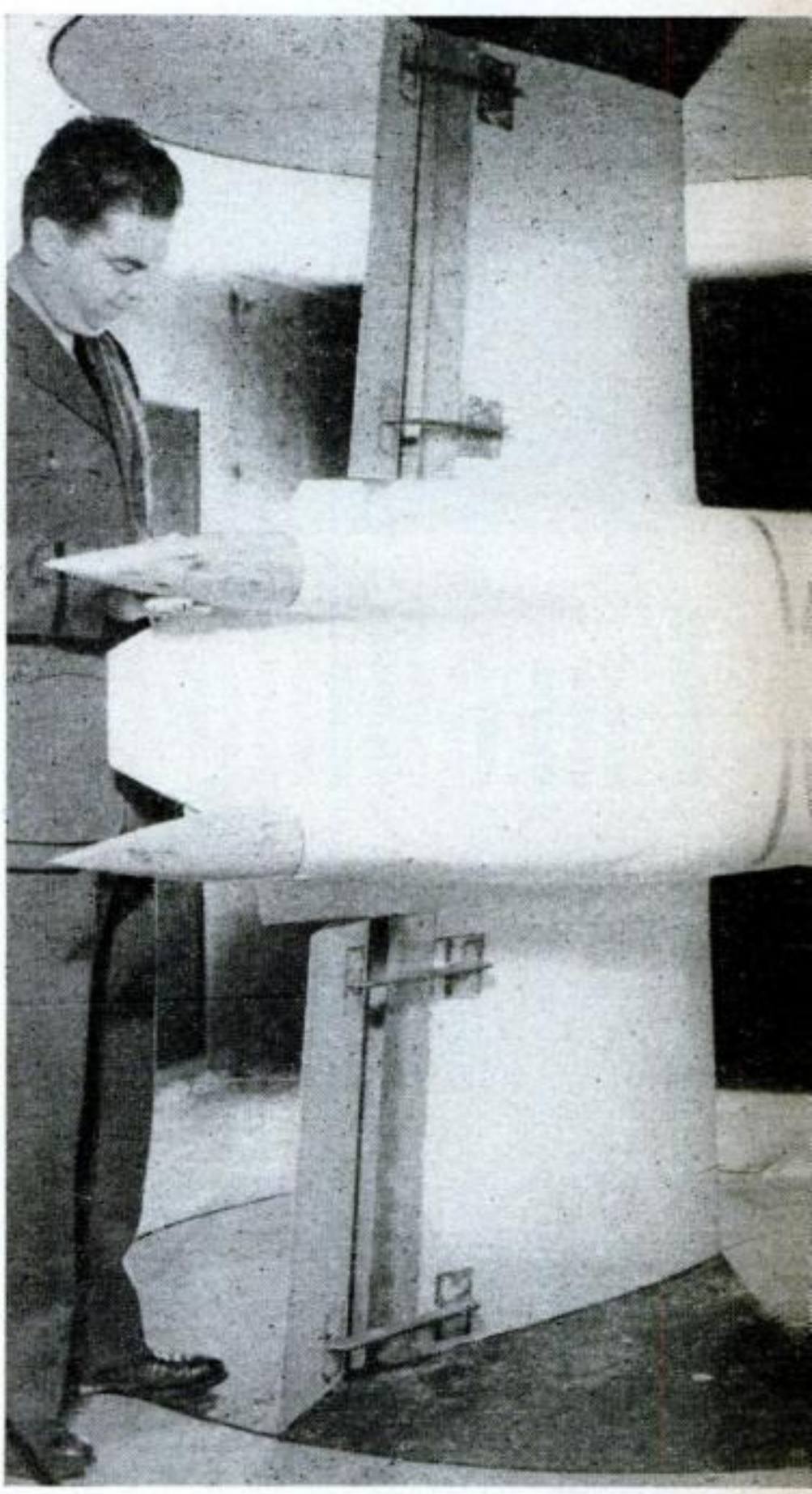
Air flow in and around nacelle will be recorded by tiny copper tubes embedded in model's surface. Pressure at 600 different points is indicated by displacement of mercury in glass tubes.



Nacelle's wing section is made of mahogany fastened to heavy steel spar. Surface is shaped by air-driven router riding on track. Templates at ends insure correct thickness and contour.



Five coats of lacquer give model hard, mirror-like finish. Each coat must be sanded smooth before next is applied. Most models are painted light gray so they will show up well in pictures.



In high-velocity wind tunnel, completed test model is mounted sideways between turntables in floor and ceiling. As air streaks past, plane will be rotated to simulate climbs and dives.

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Unrolling Logs for Plywood



By Thomas E. Riley

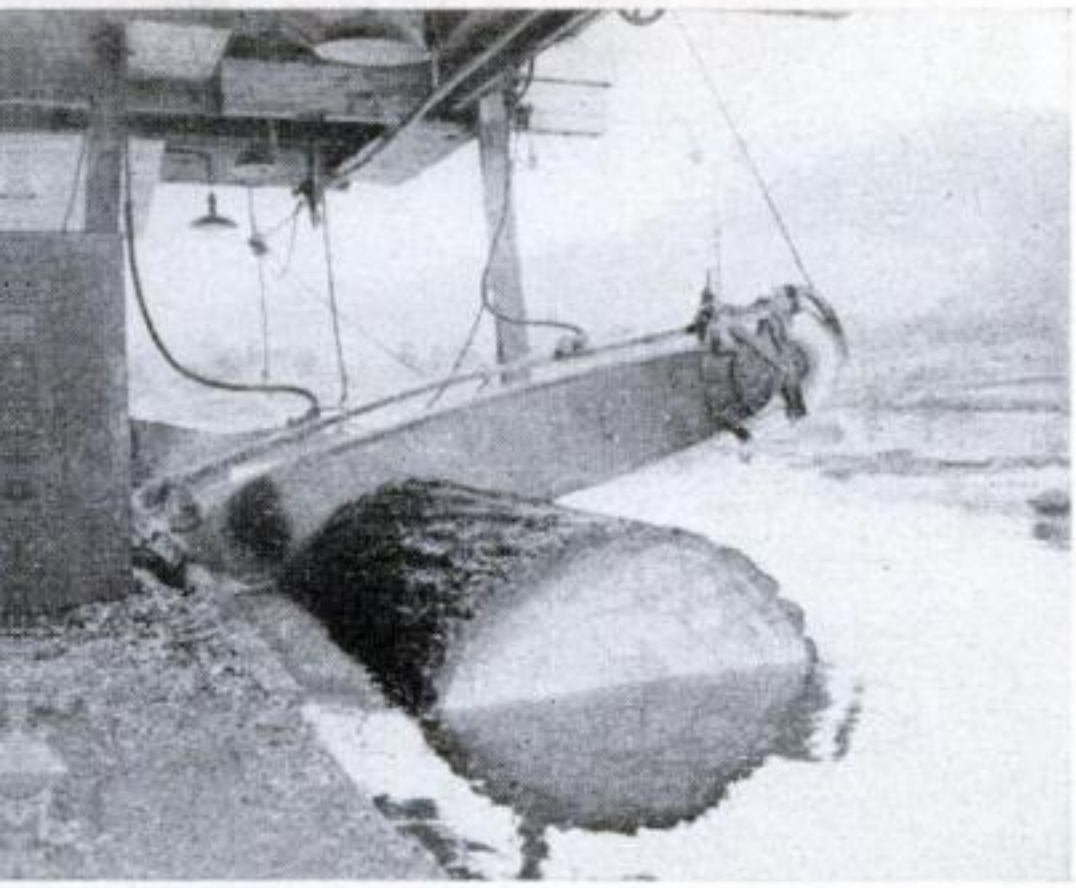
THE ancient Egyptians made the first plywood from thin, wide boards sawed laboriously by hand from the center sections of large logs. Now most plywood veneers are cut by big rotary peelers that literally unwind a log like a roll of wrapping paper.

Basically, plywood is a layercake of lumber and glue, with three, five, or seven layers of veneer. Douglas fir peels best, is used in 96 percent of all softwood plywood.

The backbone of modern plywood is its glue. Ordinary interior plywood uses a casein or soybean-base glue. Exterior plywood uses a phenolic-resin glue that forms a waterproof bond stronger than the wood itself.

In huge, modern mills like the Cascades plant at Lebanon, Oregon, where these pictures were made, America is rolling out 2.1 billion square feet of plywood a year—enough to encircle the equator in a continuous strip nearly 16 feet wide.

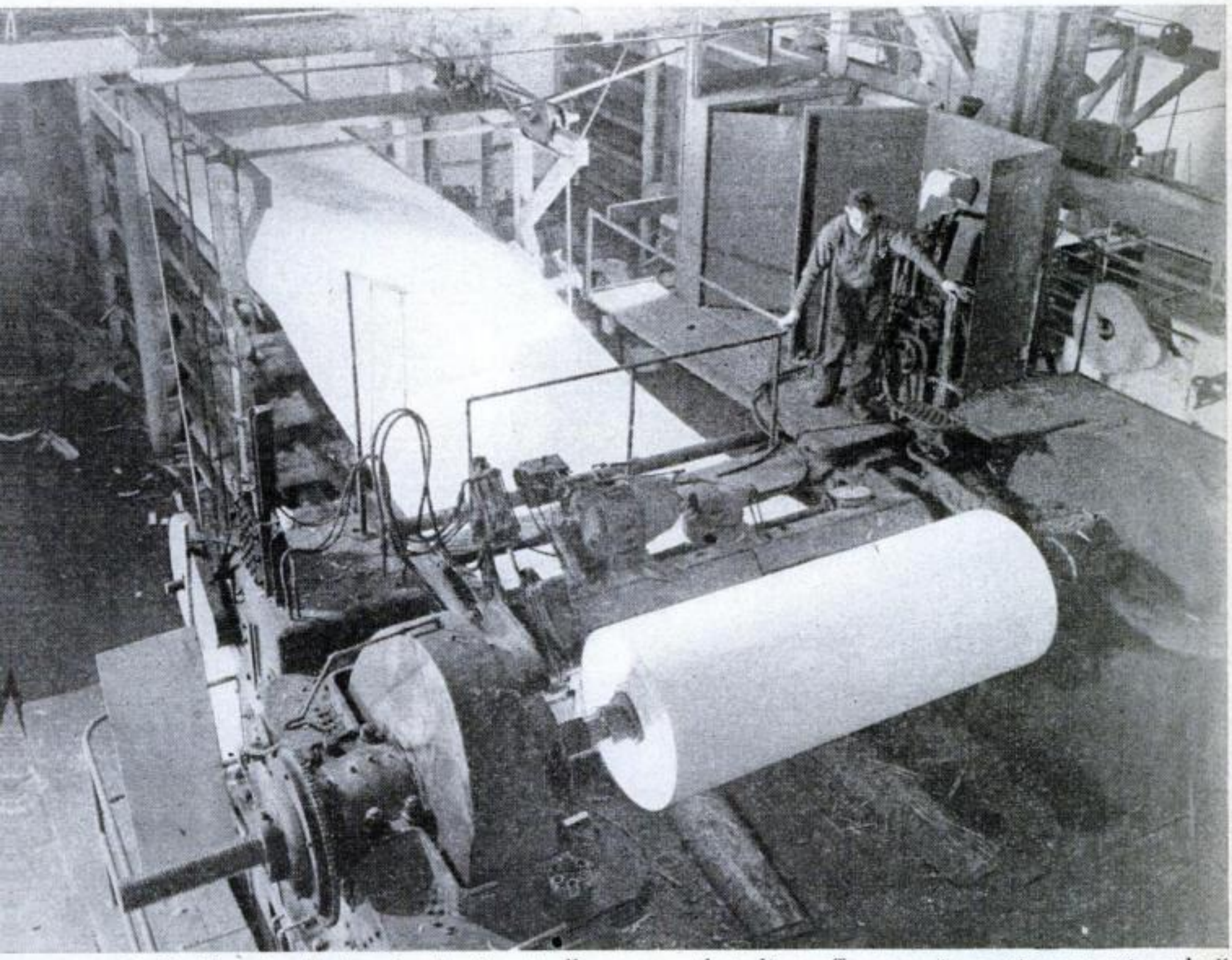
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1 Barge-mounted chain saw slices peeler logs into 6-, 8-, and 10-foot lengths. Operator's skill makes cuts come out even with logs' length. Log above is average size, about 4 feet thick.



2 On heavy "barker lathe," log is turned slowly while whirling toothed wheel, moving back and forth, chews off bark and outer, unusable sapwood like you'd eat corn on the cob.

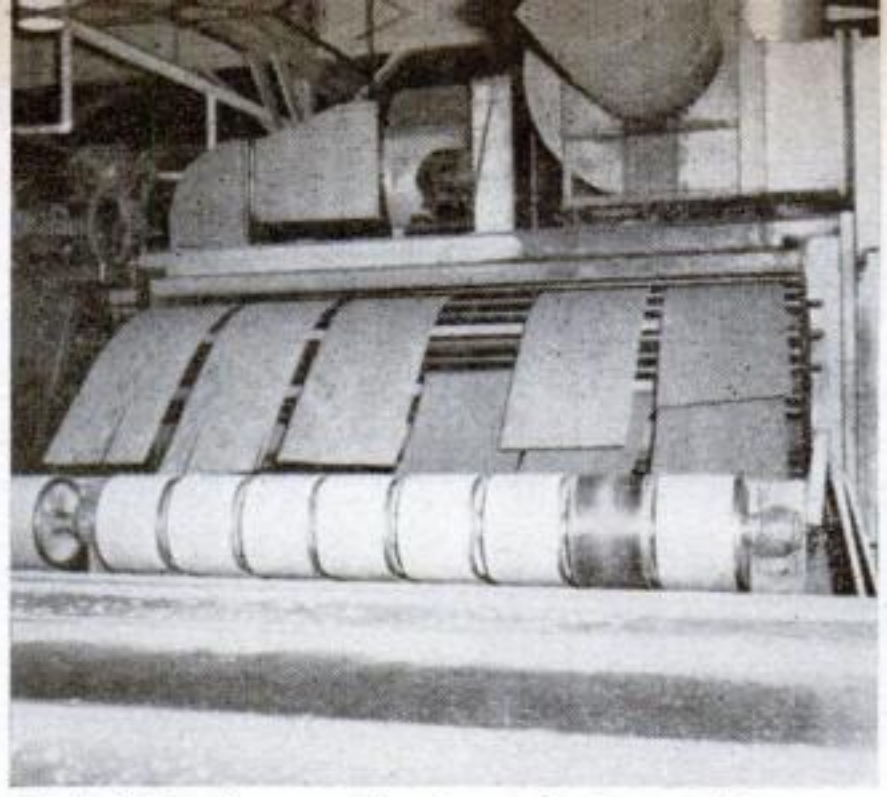


3 Peeling log looks simple, is actually complex. Giant steam-operated "peeler lathe" keeps log spinning evenly against long knife that slices off veneer in continuous strip only ⅛ or 1/10 of an inch thick. Water bath softens log's surface just before it reaches knife.

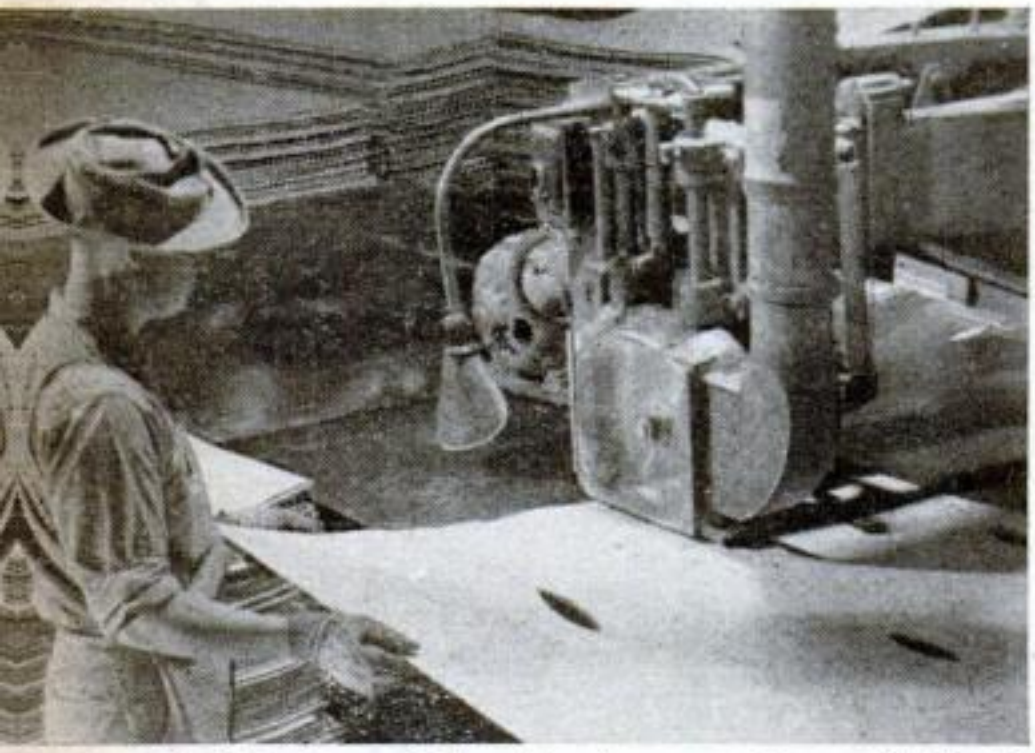
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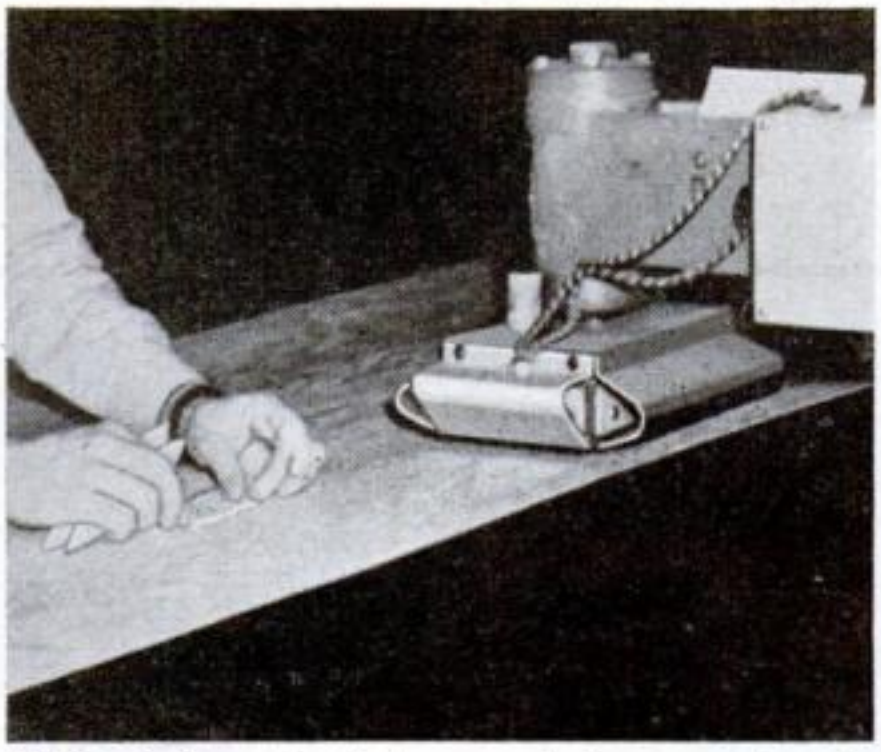
4 Freshly peeled veneer is cut into desired widths as it leaves lathe. Note narrow strips in foreground, wider in rear. Ragged, defective pieces, called "fishtails," are discarded.



5 A 15-minute trip through huge driers reduces moisture in the damp veneer sheets to 2 or 3 percent. Temperature inside reaches 350° F.—just 5° short of wood's burning point.



6 "Boat patchers" stamp out small boat-shaped sections where knots and blemishes mar veneer. Others, called "cookie patches," remove larger defects with circular cutouts.

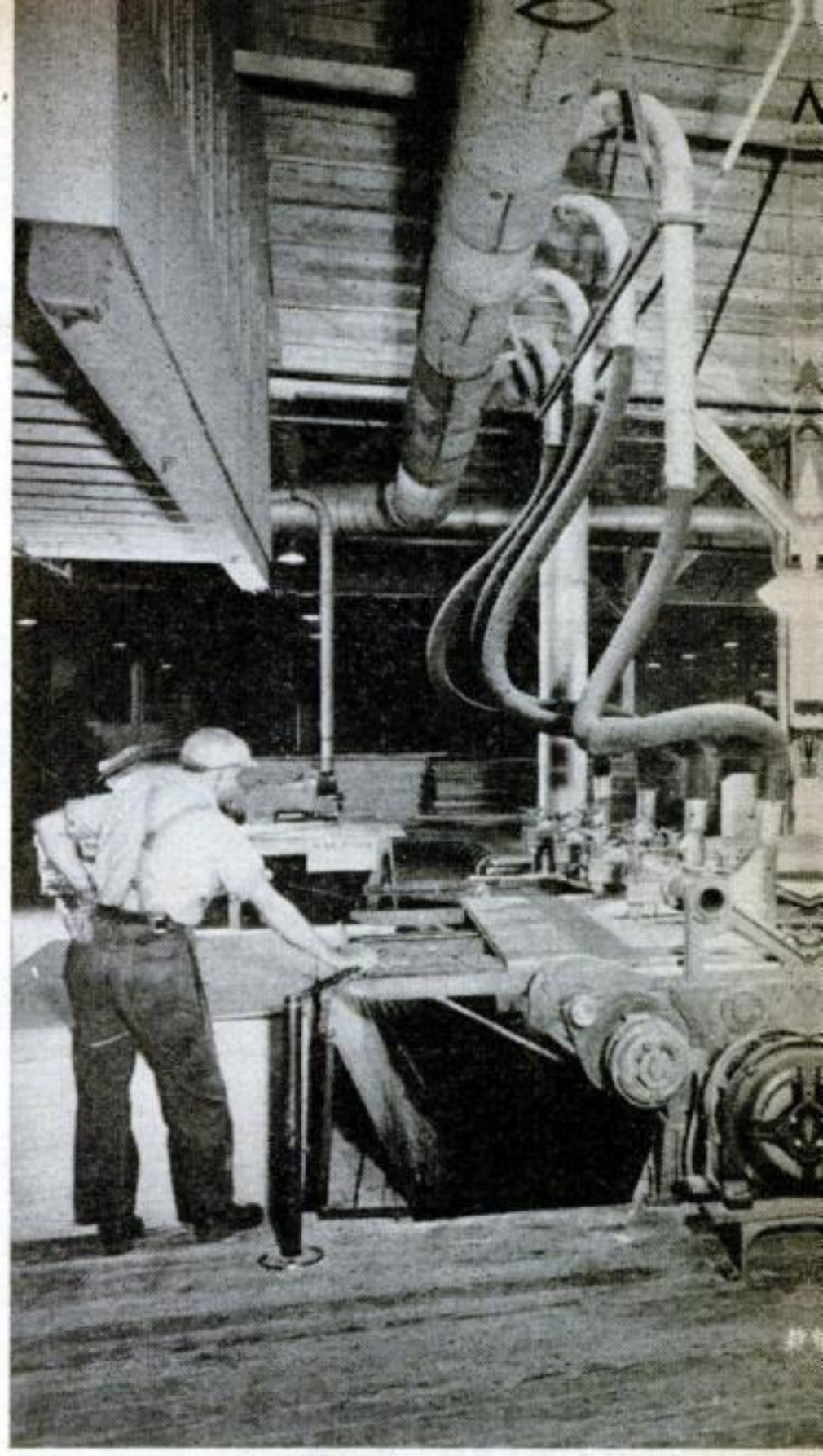


7 Boat-shaped patches, made from good parts of rejected "fishtails," are cemented into holes in veneer under heat and pressure of bonding machine that looks like an oversized flatiron.

8 Rollers spread glue on both sides of core sections as assembly of 3-ply, ¼-in. plywood begins. These are laid on larger sheet that forms bottom of panel. Then two more large sheets are placed on top, one to complete the panel, the other to start off the next one.

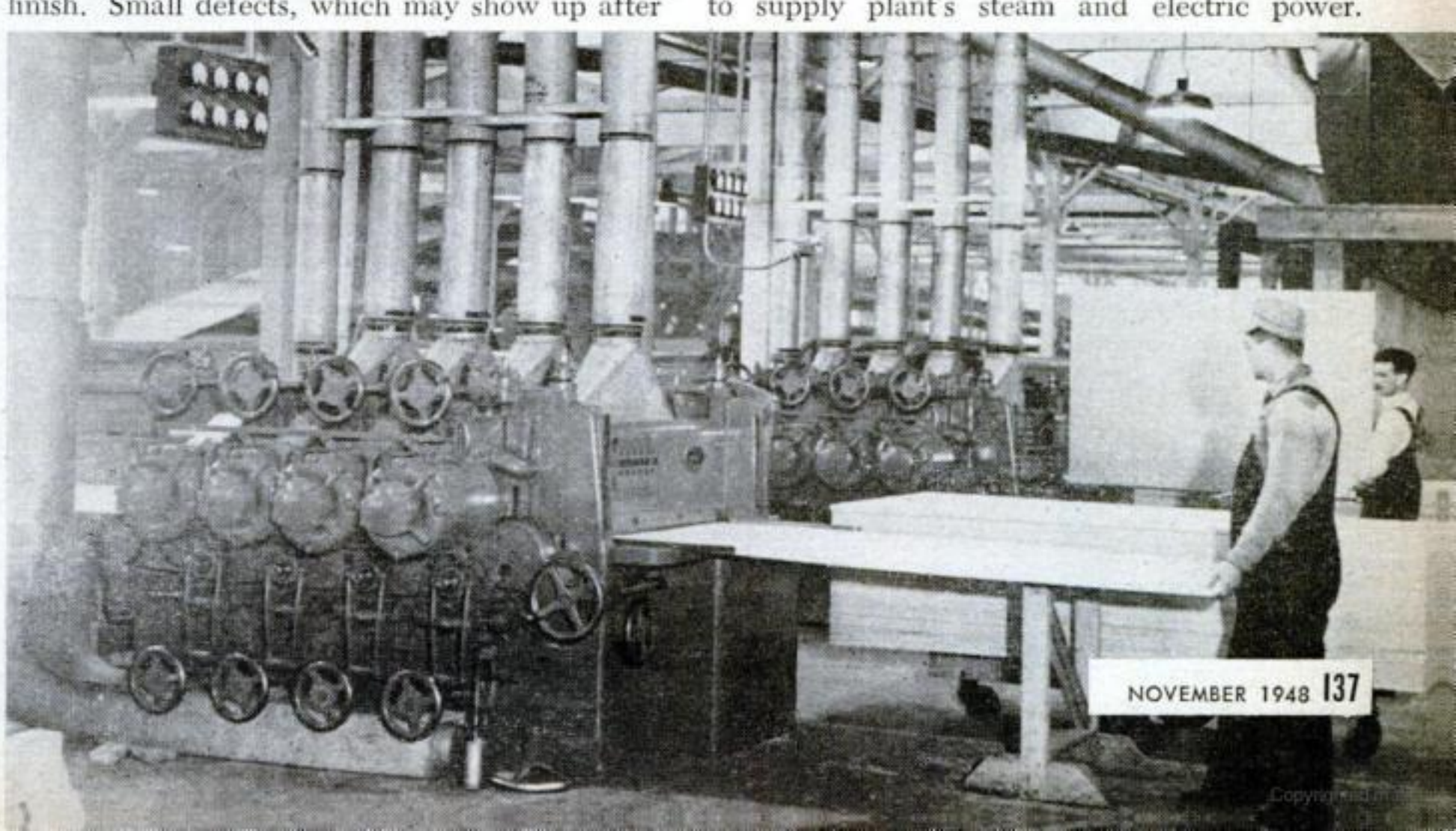


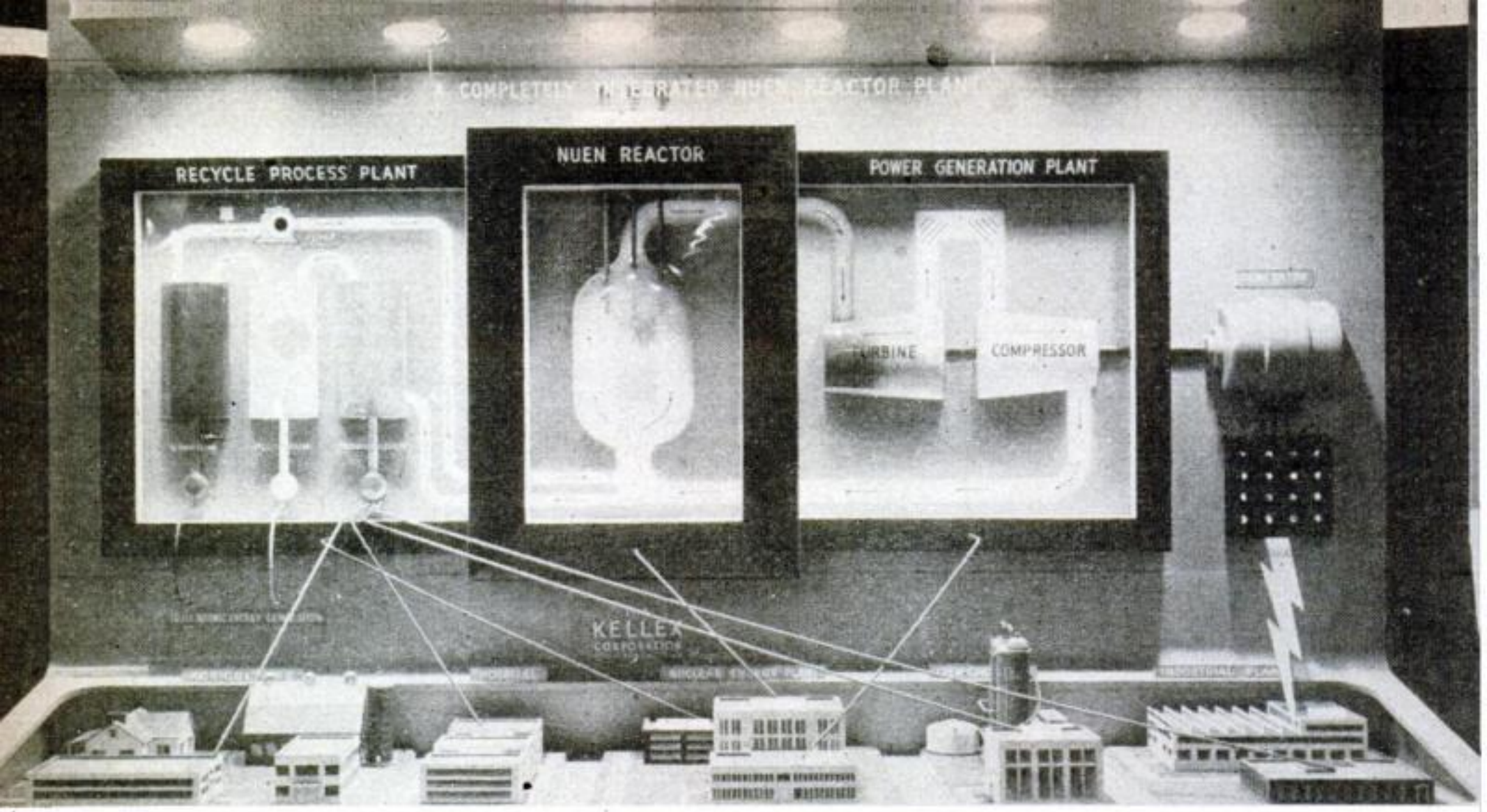
9 Hydraulic lift carries workmen up and down face of big hot-plate press, where 1,800-lb. pressure and 270° F. heat convert phenolic-resin glue in panels into insoluble plastic bond.



10 After 5-minute cooking, glued panels move to trimmer where they are cut to desired size, usually standard 4- by 8-foot panel. These can be spliced to make larger panels.

11 In final operation, panels are fed through large, four-drum rotary sanders for smooth finish. Small defects, which may show up after sanding, are then hand-patched and resanded. All waste wood, including sawdust, is burned to supply plant's steam and electric power.

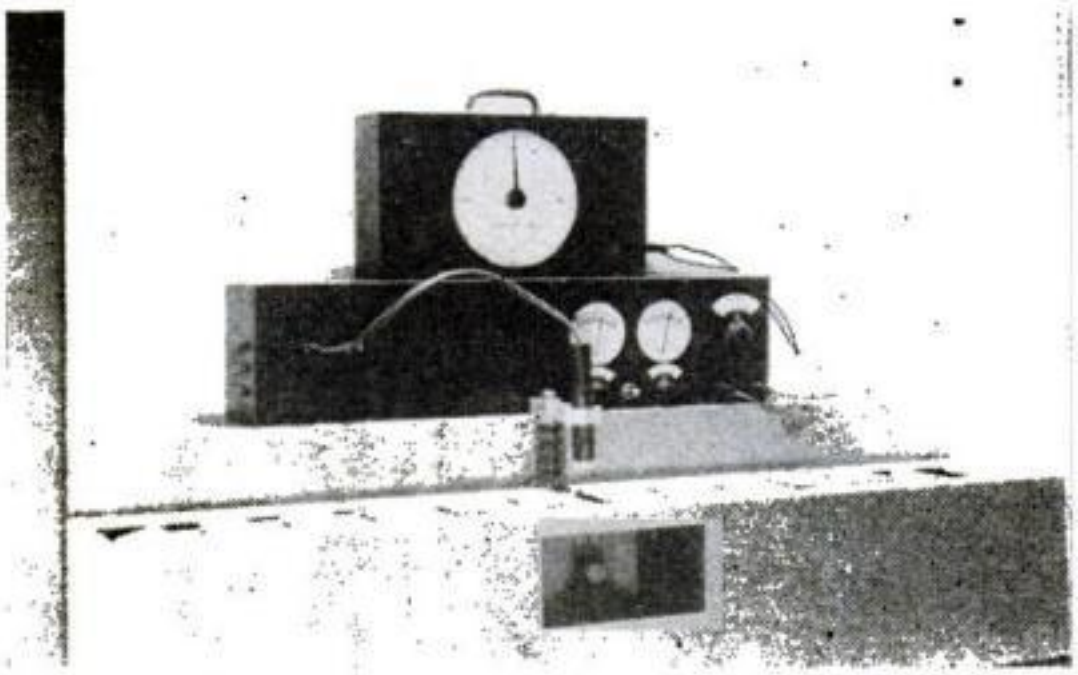




Atomic power plant of the future, called Nuen (for NUclear ENergy) by its designers, will make not only electricity, but also chemicals for bombs, industry, medicine, research, and agriculture. Display by Kellex Corp. shows how the plant will serve an entire community.

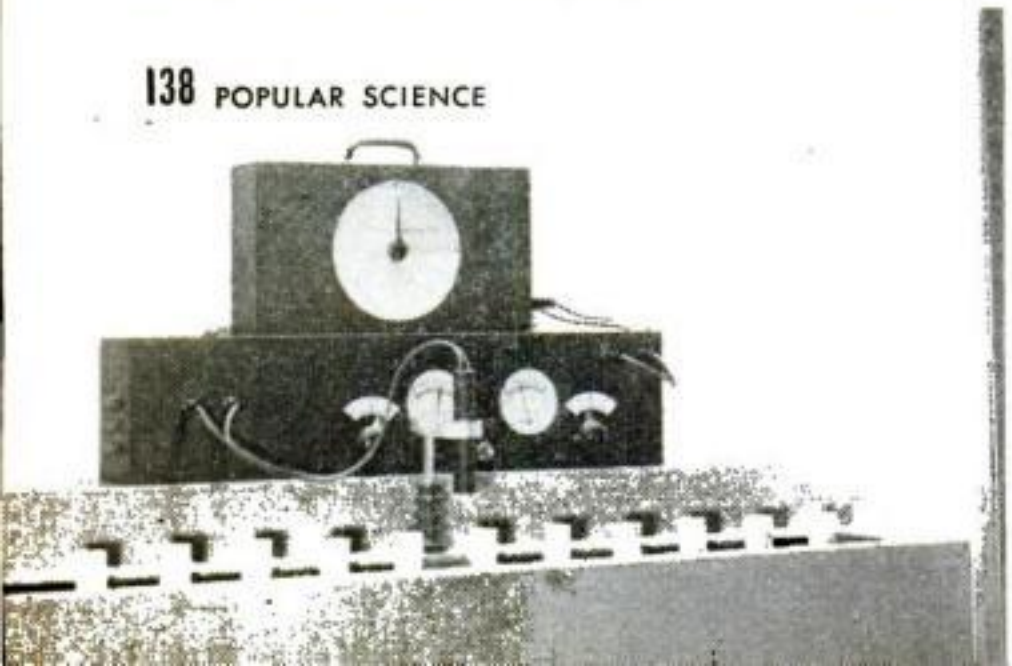
How Industry Plans to Put Atom to Work

INDUSTRY'S engineers are finally putting overalls on the atom. The first concrete examples of the ways atomic energy might find the practical uses so often predicted for it were shown in models in a recent New York exhibit. Displays covered possible applications of radioisotopes and high-voltage generators as well as nuclear power.

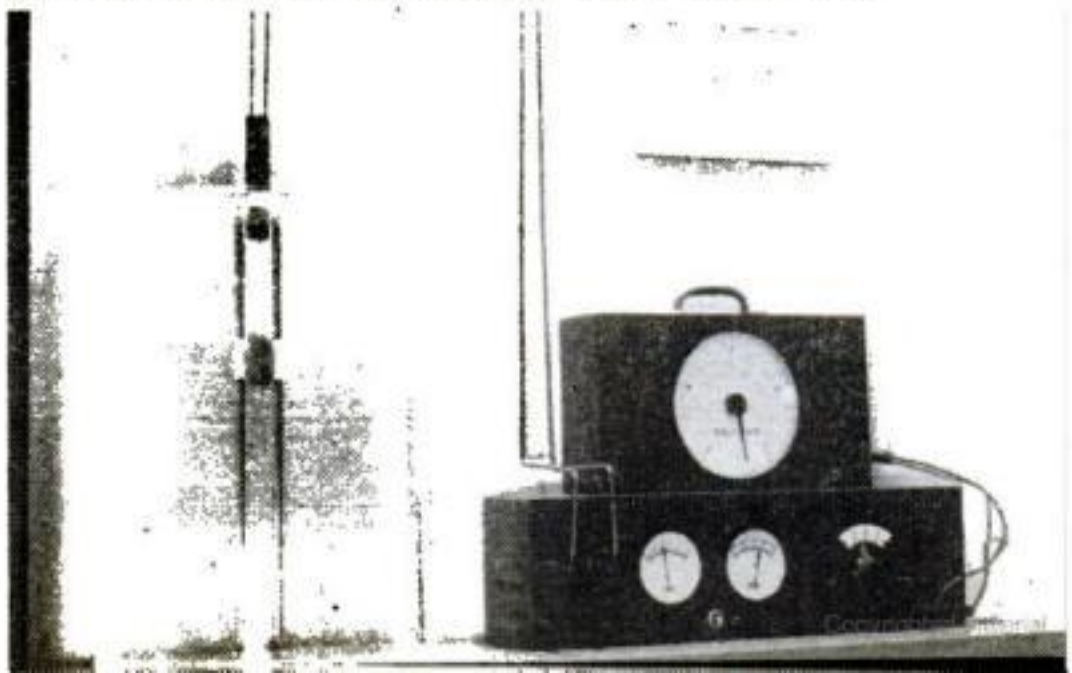


Unique measuring devices using radioisotopes were suggested in Allis-Chalmers exhibit. In model above, detector gauges thickness of metal plates by counting rays from isotope under belt.

Invisible labeling is provided by isotopes used with model shown below. Trace of radioisotope added to some metal slugs makes meter needle swing when those slugs pass under detector.

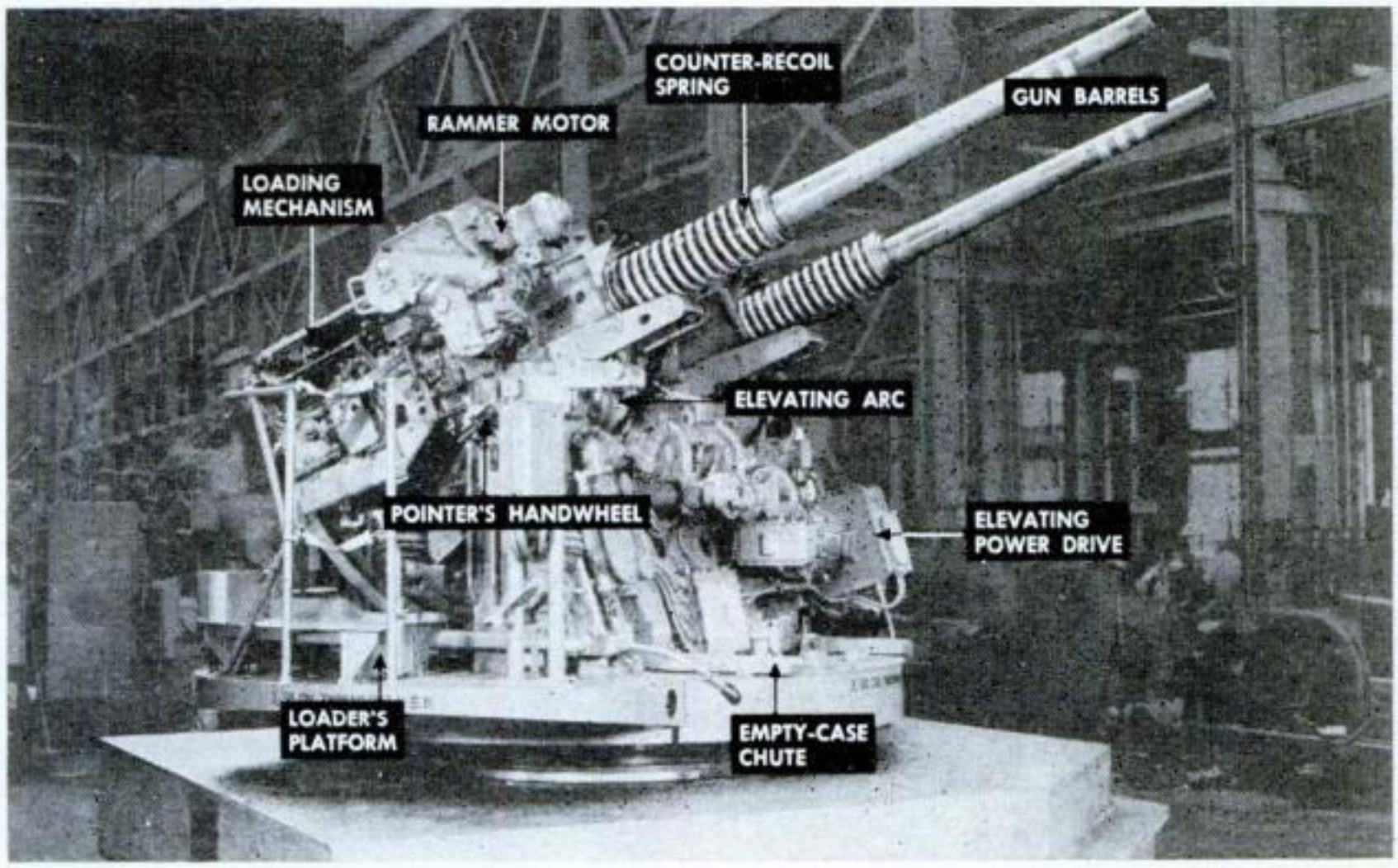


Floating radioactive capsule makes liquid gauge in another Allis-Chalmers model. Meter tells height of liquid in tank from the intensity of rays reaching the detector tube over tank.



Motor that runs on static electricity is part of Westinghouse exhibit. High-voltage charge from generator at left builds similar charge in nearest copper sphere of motor. Since like charges repel, sphere is driven away from generator, turning motor at speeds up to 100 r.p.m.

Navy Develops New 3-in. AA Gun



THE Navy's answer to suicide dive-bombing is a new 3-inch antiaircraft gun that is reported to fire more than 150 high-explosive shells a minute. Designed to replace the Bofors 40-mm. gun used against close-in attacks in World War II, it has twin barrels each 150 inches long and an automatic loading mechanism.

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New Toys

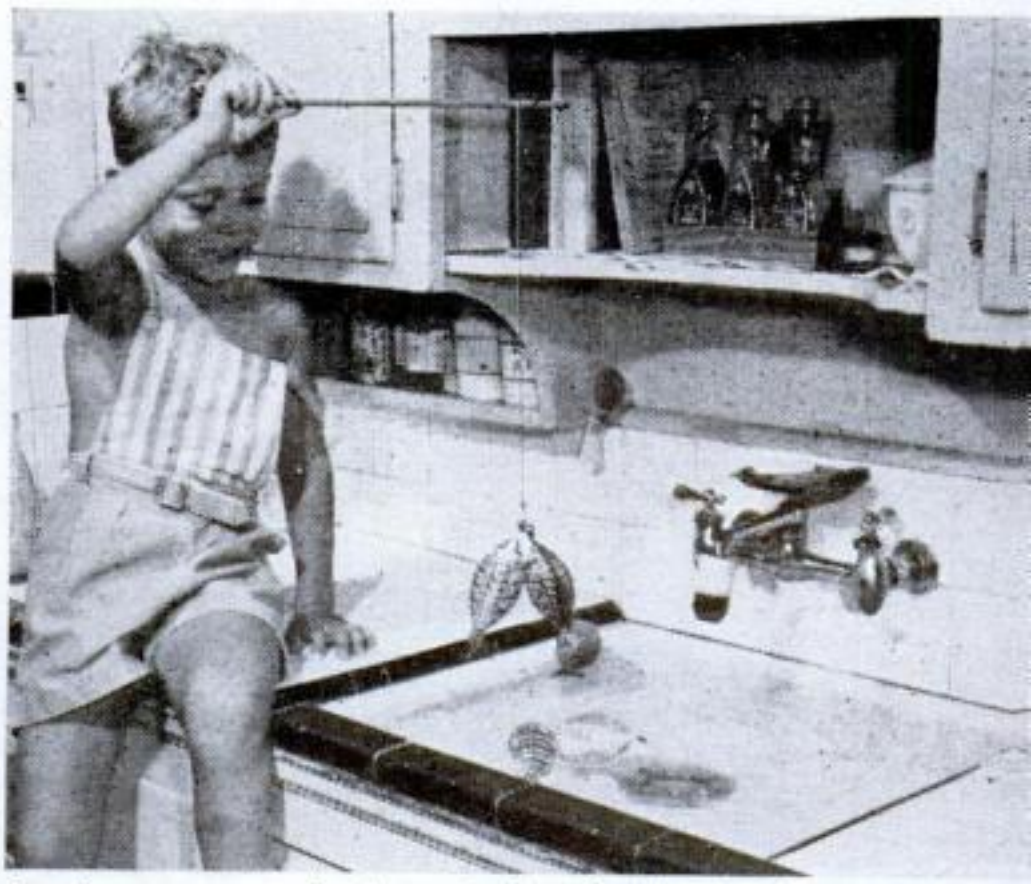
IN STRIDE with the rising birthrate, U.S. toy makers are setting another production record this year. Sales, now booming all year 'round, reach their annual peak in the month from Thanksgiving to Christmas. At the present pace, they will climb to a total of $300,000,000 for the year—$50,000,000 over 1947's mark. Here are some of the newer toys now on the market.



Make-believe electric shaver buzzes realistically. It has a wind-up motor and rubber vacuum cup on the cord to "plug" into any wall. Maker is Ideal Novelty & Toy Co.

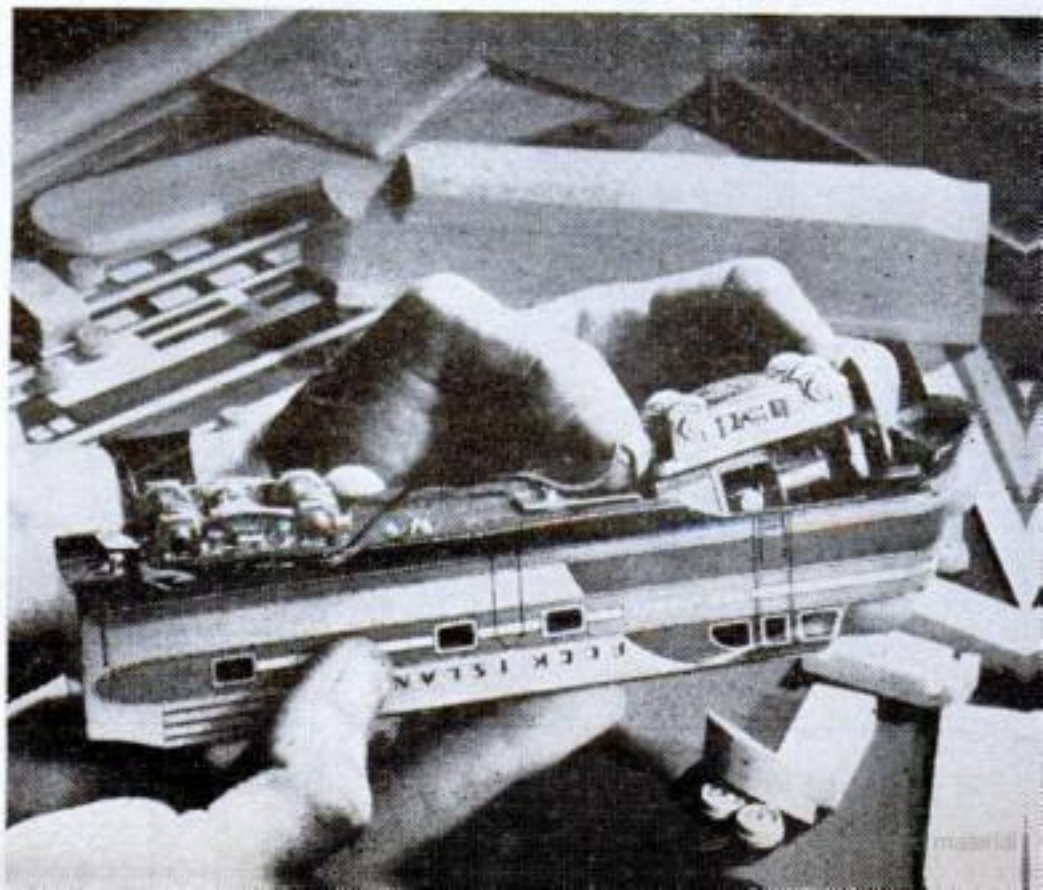


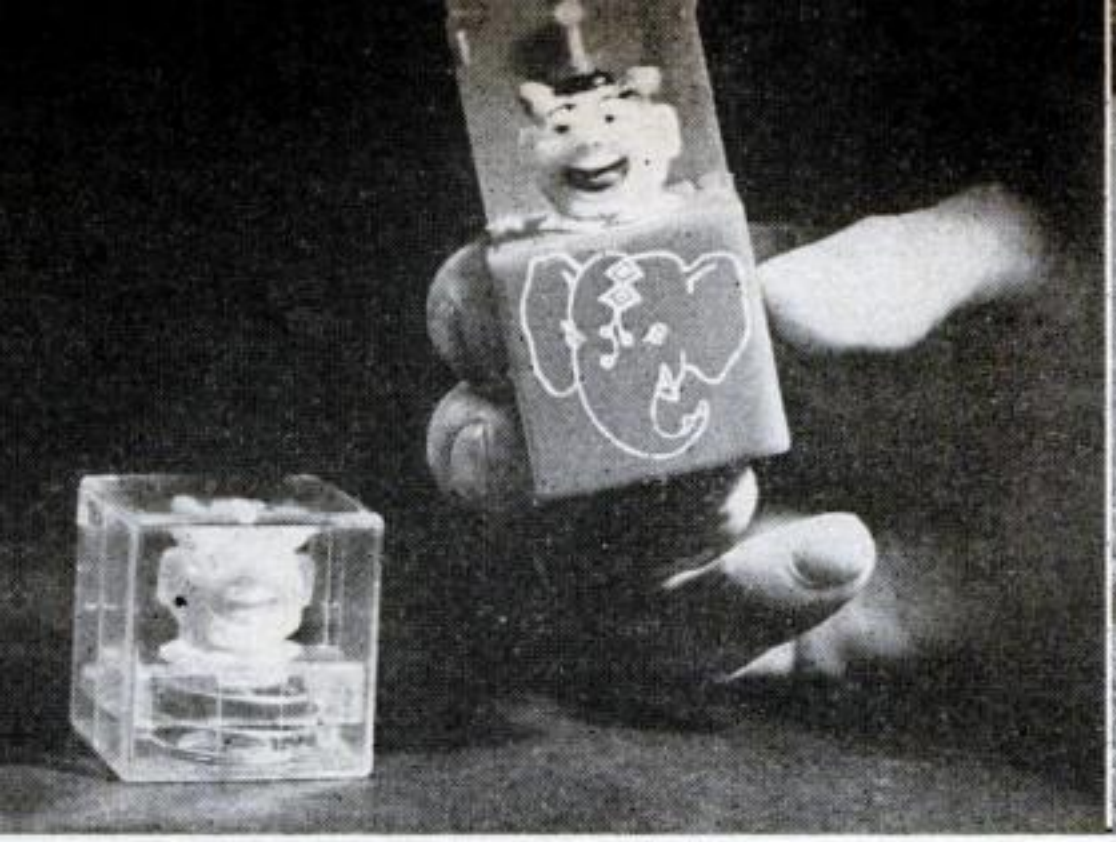
Combination tricycle and trailer wagon lets a child take a passenger or his toys for a ride. The Hettrick Mfg. Co. makes it of heavy-gauge steel with 12-, 16-, or 20-inch front wheels.



Junior can catch these inflated plastic fish in the kitchen sink or bathtub. Magnet on end of the line "hooks" them by metal rings in their noses. Set is made by Transplastic Mfg. Co.

Wooden scale model of Rock Island locomotive can now be electrified to pull HO-gauge train. Strombeck-Becker, maker of wooden train, sells plans for adding motor, power trucks.





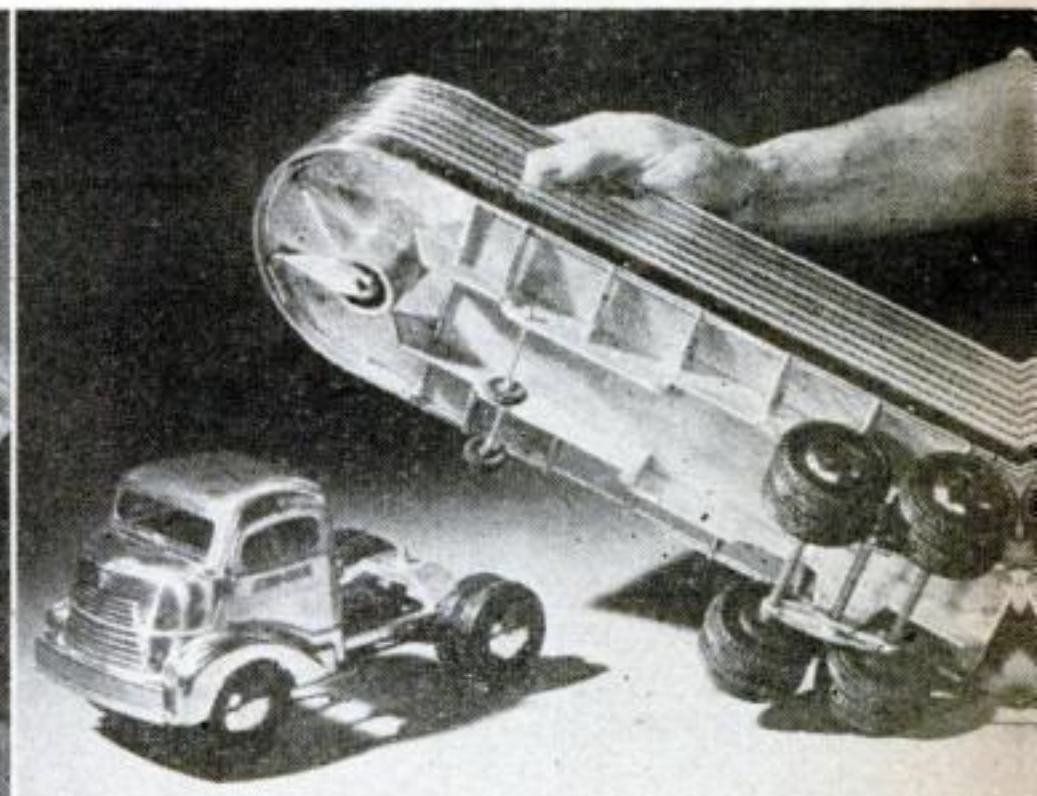
Jack-in-the-box, propelled by a spring, pops up when this 1⅝-inch plastic cube is squeezed. Other toyland characters also come in pop-up boxes, made by the Noma Electric Corp.



Weighted at bottom with sand, punching bag comes back for another smack when hit. Made of plastic by Marty Gilman, Inc., inflated toy can double as a football tackling dummy.

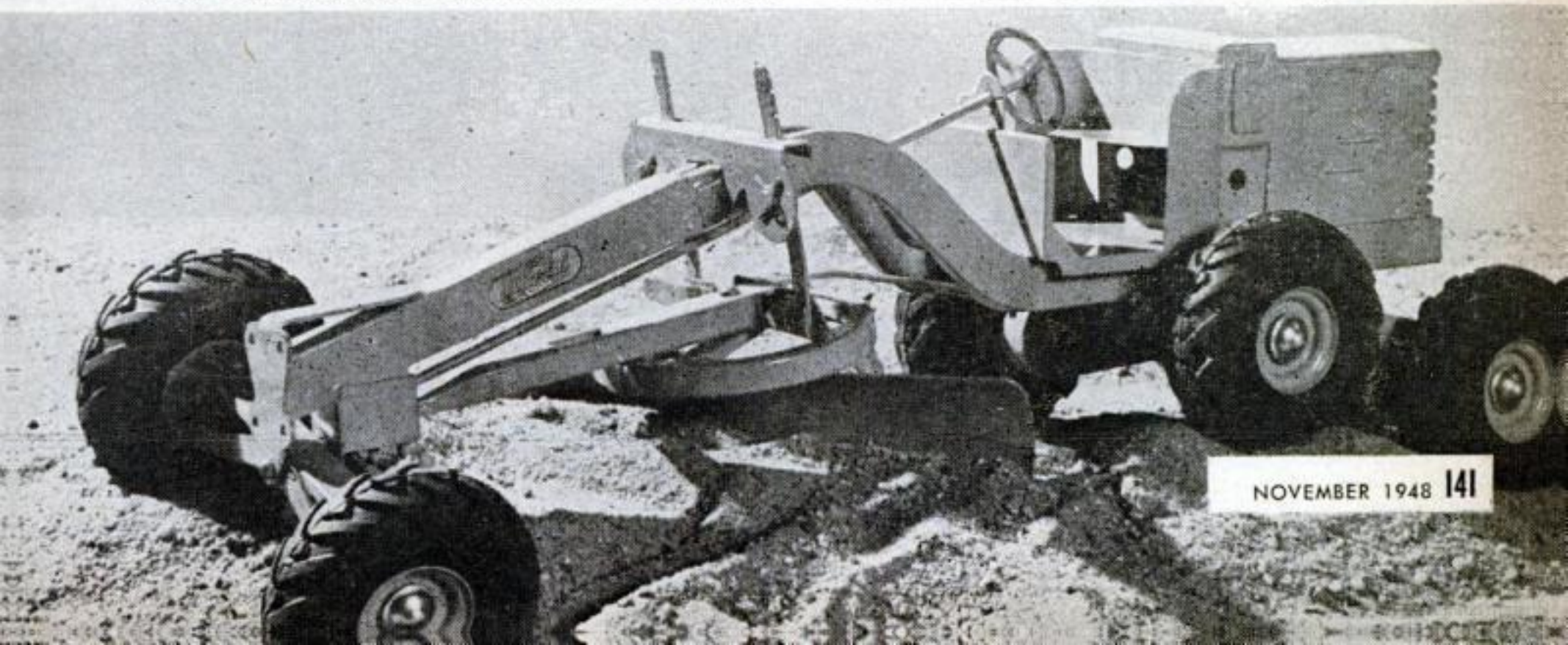


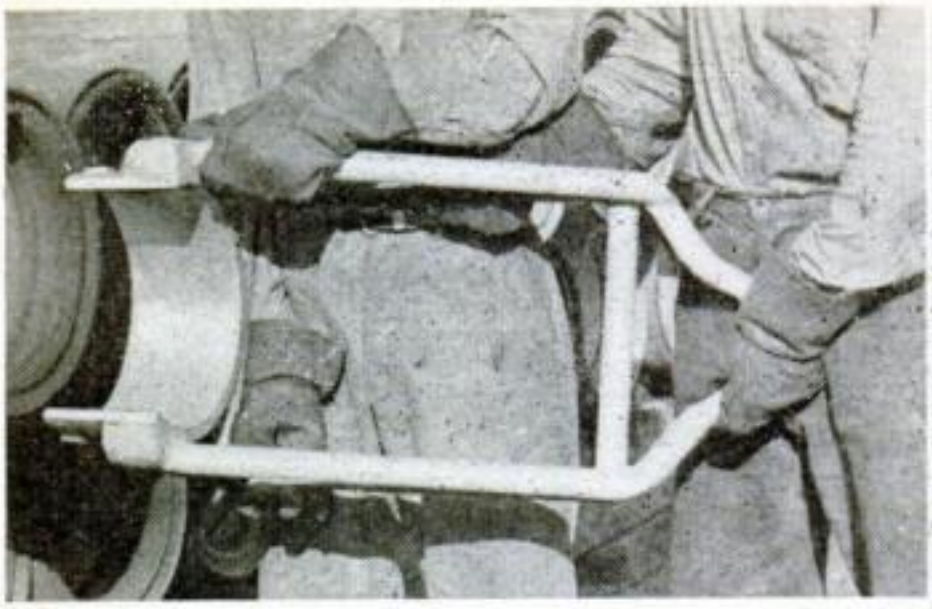
Hockey teams chase tiny puck over "ice" in this new table game, made by Remotrol Co. Two opponents maneuver players by moving magnets on sticks under raised playing surface.



Model trailer truck, based on actual Fruehauf design, is one of a line of Smith-Miller toy trucks. Sturdily built of aluminum, it has die-cast frame, dual rear wheels, retractable "landing gear."

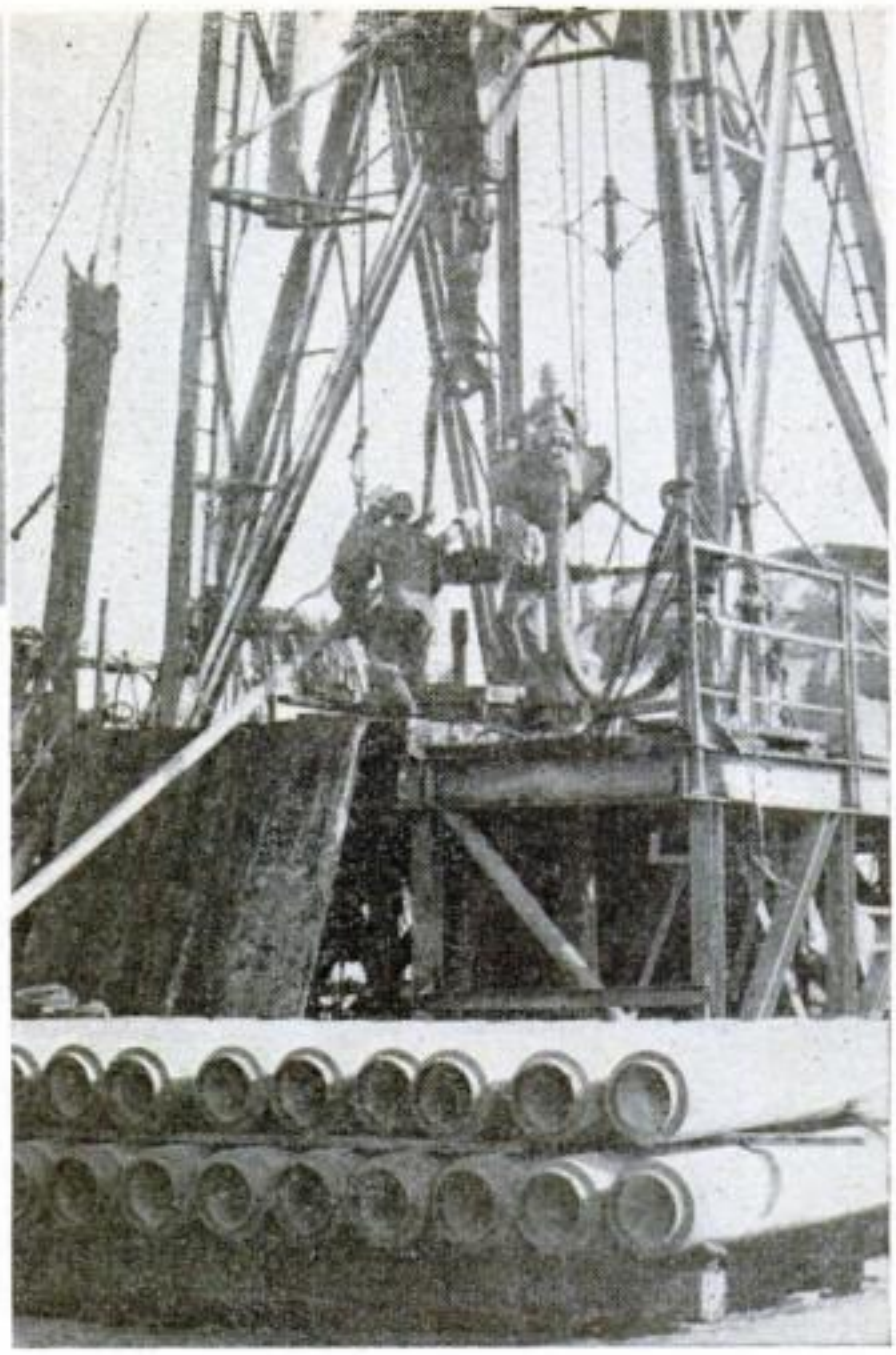
Workable road grader is latest addition to Charles Wm. Doepke Mfg. Co.'s series of scale-model road equipment. This 26-inch miniature of an Adams machine has movable steering gear and knee-action, tandem rear wheels. The pushing blade can be raised, lowered, moved in a 90° arc, and locked in any position. Grader weighs 10 pounds to the real thing's 10 tons.





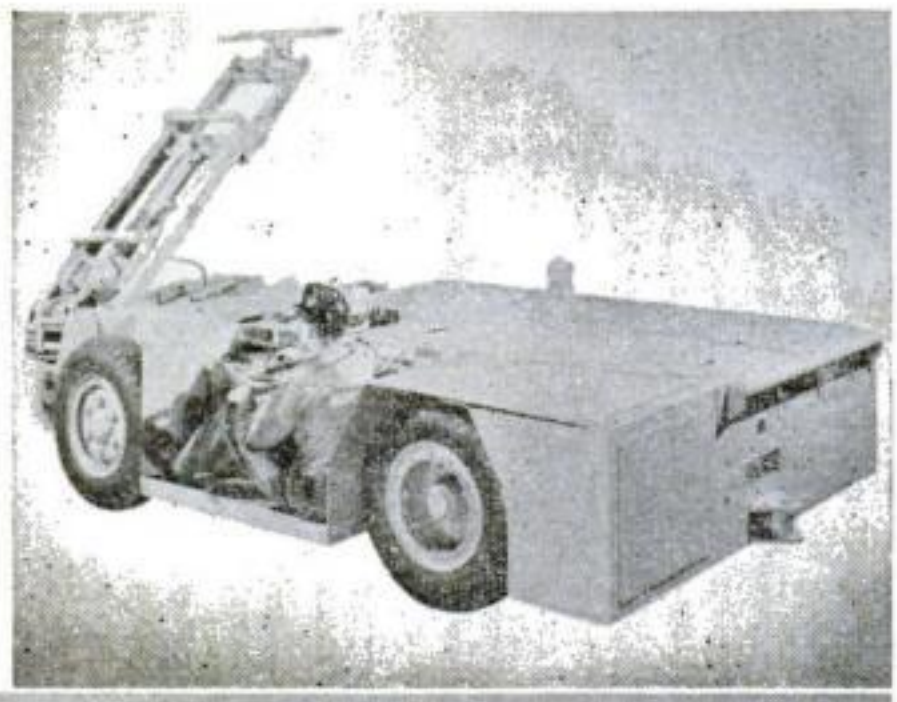
Concrete Pipe Is Tough

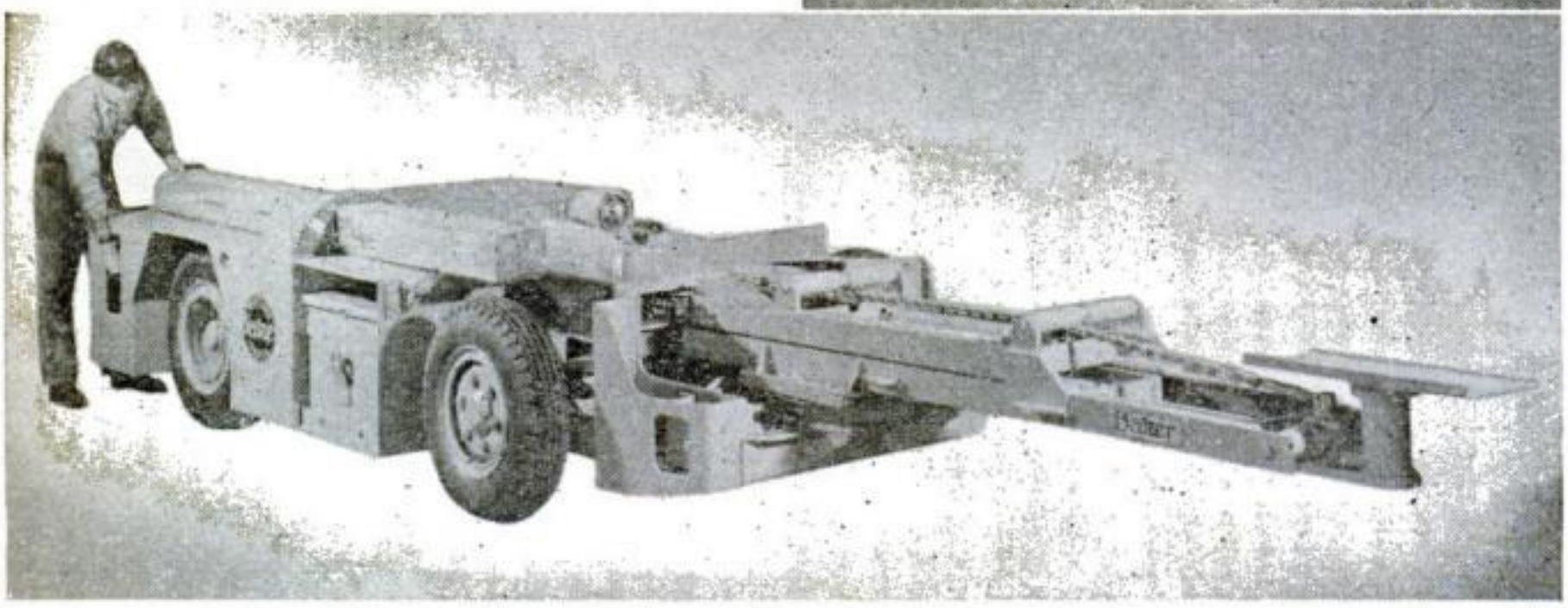
THE oil-well casing shown at right, made of concrete spun around a reinforcing framework of spiraled steel rods, saves nine-tenths of the metal used in conventional castings. With the superstructure revolving at 3,000 r.p.m. as concrete is shot through, centrifugal force causes the cement to set with unusual compactness, making it nonporous. The inventor, Charles E. Knox, of Tulsa, Okla., claims that the casing also resists corrosion. The photo above shows a special grappling hook used for handling the pipe and lowering it into an oil well.



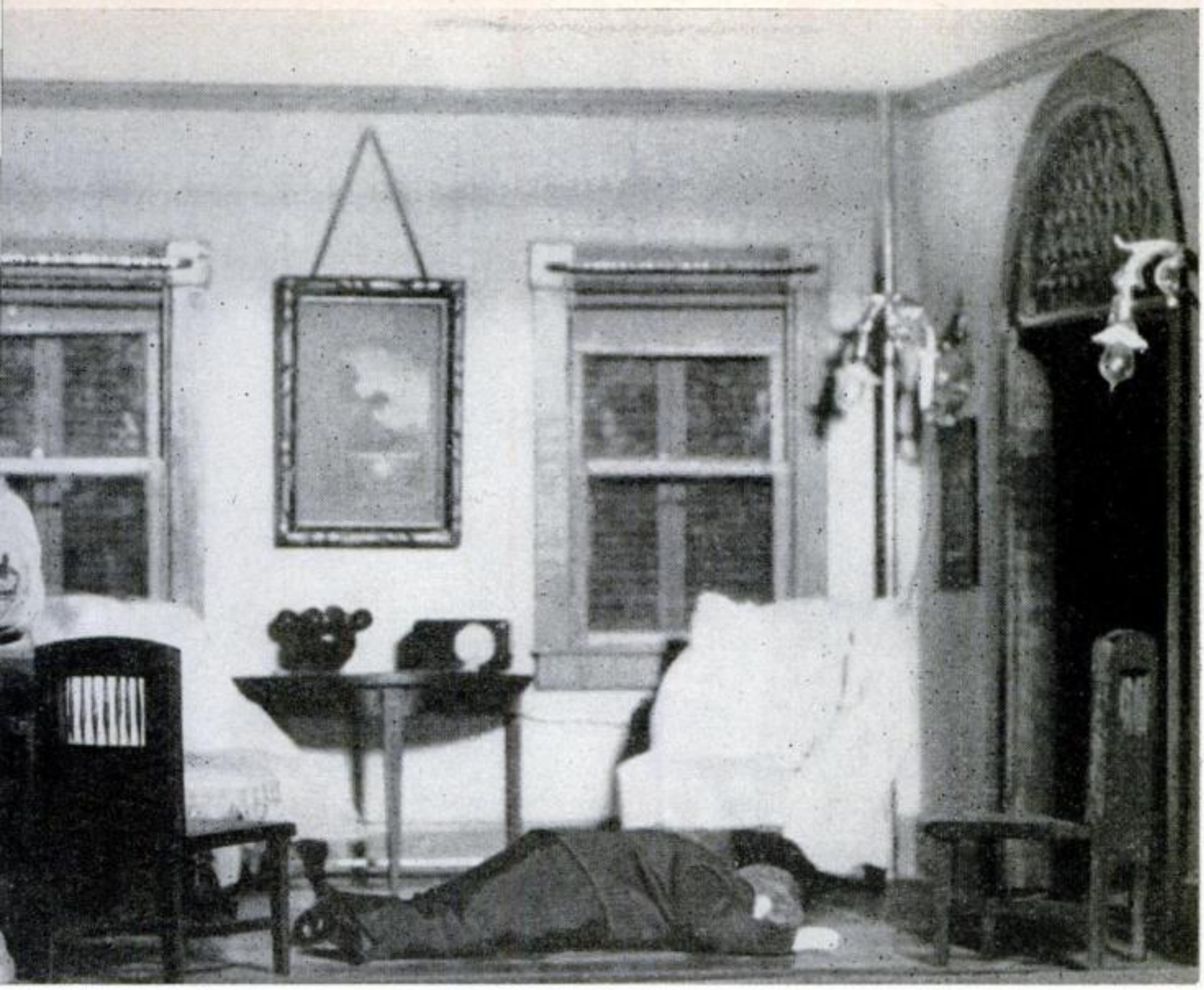
Machine Aids Timbering

THE crossbars and side posts that support coal-mine shafts are erected more quickly and safely with this timbering machine developed by the Baker-Raulag Co., of Cleveland. At right is shown the hydraulically operated swinging boom that holds crossbars against the mine roof while posts are cut to length by a circular saw mounted on the machine, as illustrated below. This photo has the boom lowered to show the saddle in which crossbars are held. A trailer, not shown, carries bars, posts, and wedges.





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Midget corpse sprawls amid furniture built to scale for study at Harvard Medical School.

Dolls Die for Crime Doctors

By William Gilman

THEY'RE teaching murder at Harvard—but the victims are dolls, and so are the killers.

These 6-inch actors populate a pigmy world of violence called the Nutshell Studies of Unexplained Death. Their re-enactments of crime are used by the university's Department of Legal Medicine to teach medical students and visiting coroners and detectives how to solve strange cases of sudden death.

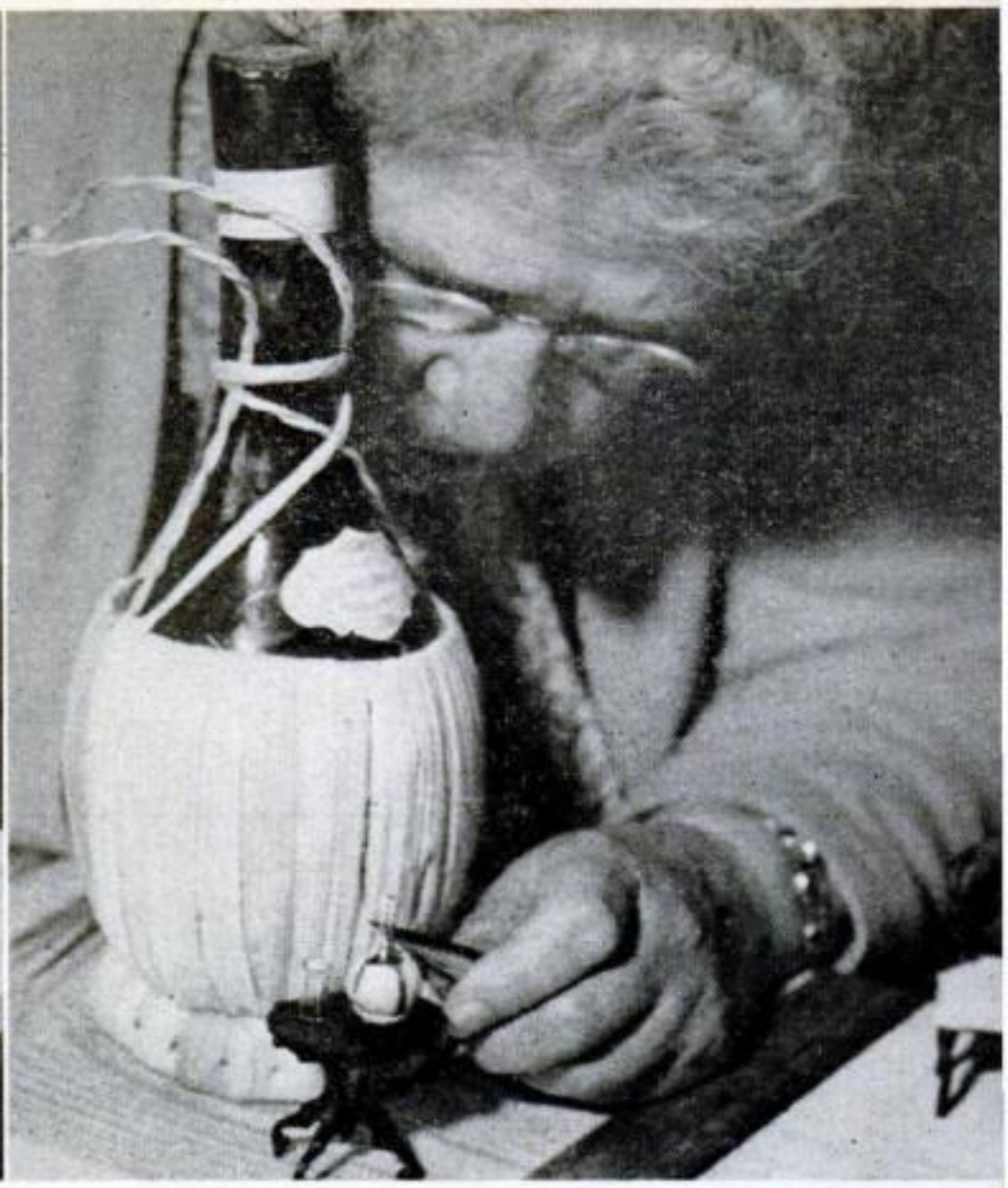
One of the models, "The Case of the Hanging Farmer," looks clearly like a suicide. A man's body is hanging at the end of a rope in the barn. But the real answer is: an accident. The farmer just wanted to frighten his wife, with whom he had been quarreling. He had never intended jumping off the orange crate on which he was standing, with noose around his neck. But his weight was too much for the crate's slats. The broken crate gives the clue.

Another model is a double take. Scene 1 shows a murdered man on the living room floor. Scene 2 depicts the room 45 minutes later. A dumb-cop doll is loafing in the doorway, watching the wife doll sweep up. They've already carried the body to a couch, violating the principle that nothing must be touched—especially the deceased person—before the medical examiner arrives. Care-

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Murder scene is constructed in minute detail for Harvard course to teach medical examiners how to spot clues in cases of unexplained death.



Tiny wine bottle for scene of fatal brawl is compared by Mrs. Frances G. Lee with the real one she copied. Scale is one inch to the foot.

ful eyes can spot 31 changes in the room between scenes.

The dolls and the stage sets in which they live and die are the handiwork of Mrs. Frances G. Lee, an elderly woman with a nimble brain and deft fingers. Since their purpose is to teach students that nothing can be taken for granted, Mrs. Lee has to be mighty careful herself. In painting a dead doll's face, for instance, she has to know the exact difference in color between the cherry-red of carbon monoxide poisoning and the various shades of purple that an ordinary corpse will acquire.

To provide every detail, Mrs. Lee's models are as realistic as life and death. One of them shows a house and basement. A tiny bulb inside the furnace makes it glow. There's even a mouse—made from half a pussy willow rubbed with soot—caught in a trap. Heel dents in the floor, cigarette butts, whisky bottles, powder burns—all are on the scale of an inch to the foot, to match the 6-inch dolls.

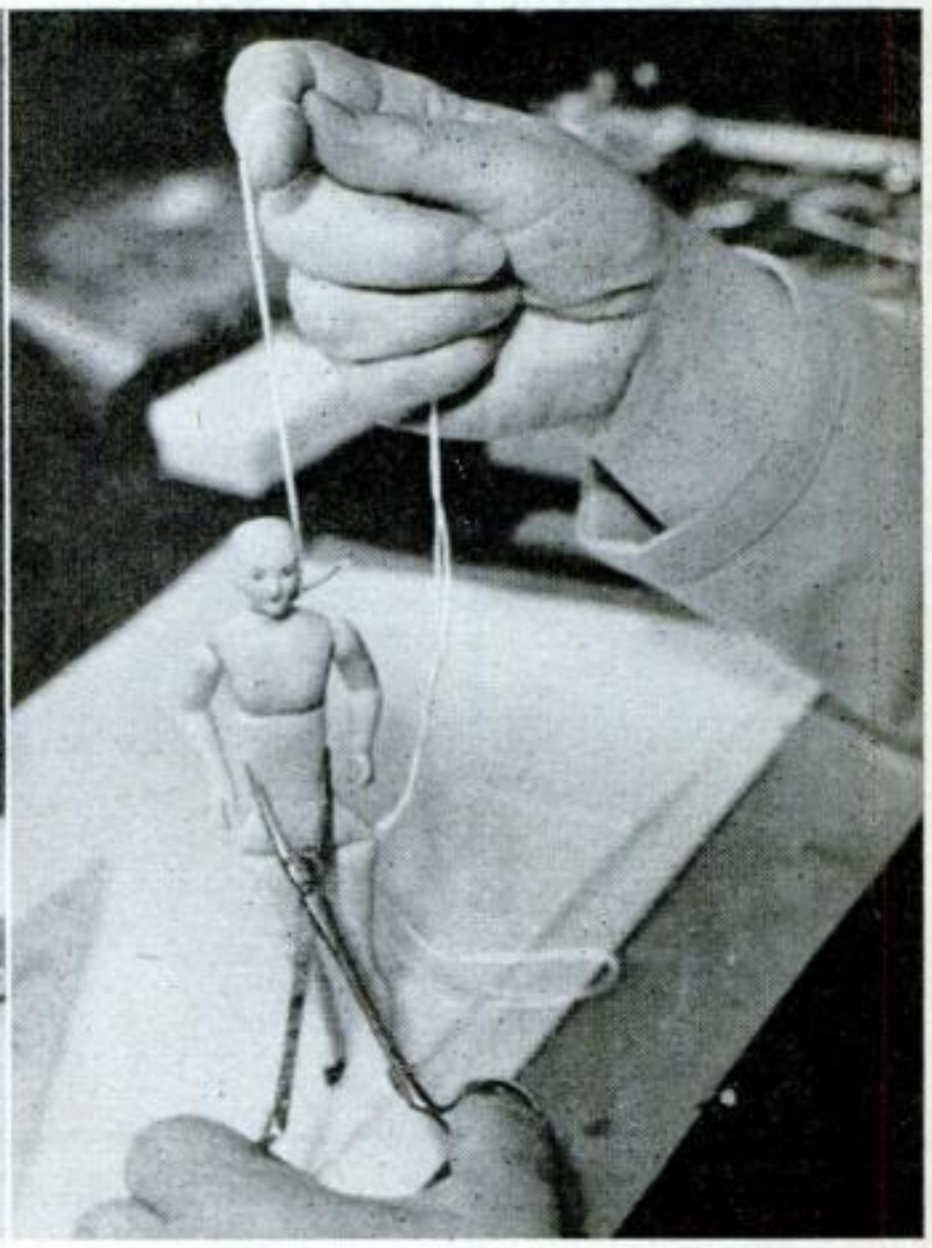
A skilled carpenter, Ralph Mosher, is Mrs. Lee's only helper. He uses nails made from needle points. To build a barn, he needed weathered boards and went to a real barn for them. He carefully sliced off the inside and outside layers of the one-inch boards, threw away the middle, cemented the two layers together—and had weathered barn lumber 1/12 of an inch thick.

The hardest work, Mrs. Lee says, is killing dolls properly. Made of bisque, they are so hard that they can be cut only with a diamond saw or dental drill. To make a murder victim sprawl naturally, slabs are sawed away at the shoulder and waist, and a pocket is cut into the mattress or floor. Threads from the arms, legs, and head are fastened underneath to produce the correct rigor mortis.

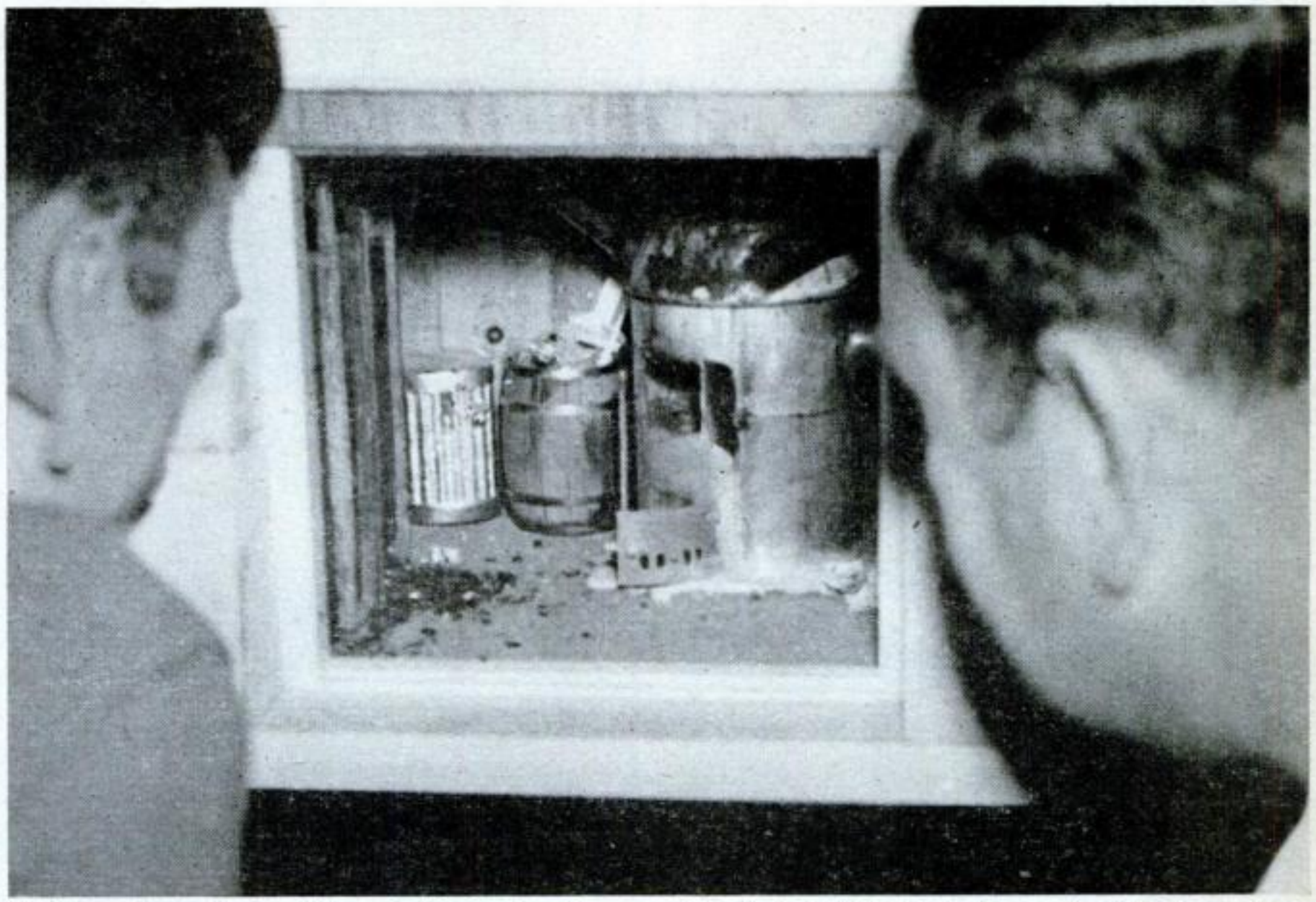
Mrs. Lee dedicates her Nutshell Studies to the proposition that we'd sleep easier if the law convicted more killers and pestered fewer innocent persons. Her models are booby traps driving home the lesson that a sleuth mustn't jump to conclusions. She tells of the hospital patient who died and was written off as a meningitis victim, until the medical examiner took a hand. He found meningitis infection all right, but found also that the bacteria had entered through a tiny, unnoticed wound—the real cause of death. The man had been stabbed with an icepick.



Doll-size parrot will witness murder in one of Mrs. Lee's tableaux. On the same scale are the dish of fruit, napkin in ring, coffee dishes.



Victim in hanging case is fitted with noose and tested for proper dangling position and elevation before getting clothes and hair-do.



Visiting detectives at Harvard examine basement scene for clues to murder of doll found dead in locked room upstairs. Carefully constructed details include coal spilled on floor, rust on furnace, unemptied trash barrel. These may indicate how long victim has been dead.

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Homemade Slingshot Launches Plane



WHEN Alfred B. Bennett decided he would like to fly between his home and his job at an airport several miles away, instead of driving, he faced a problem.

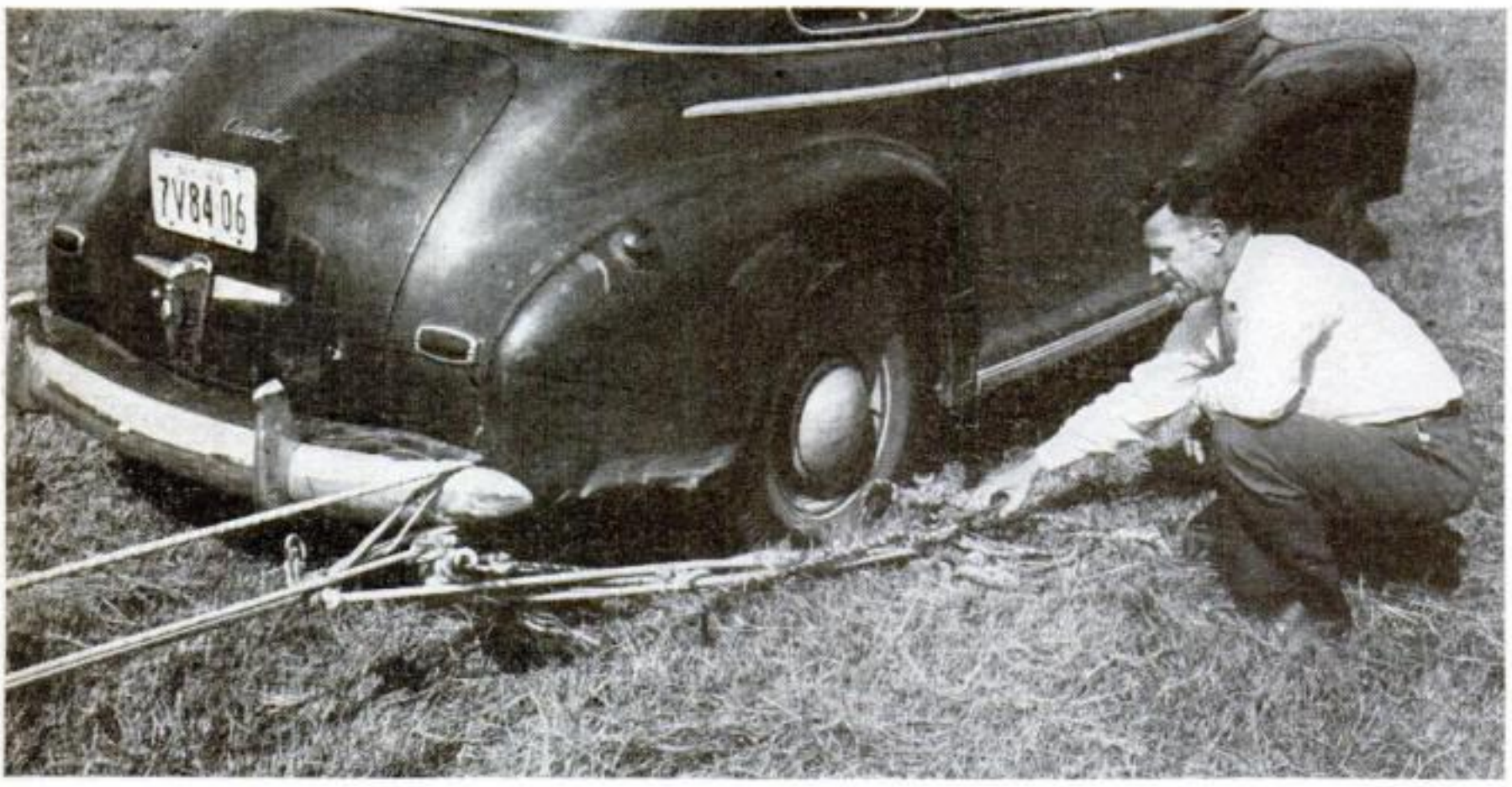
His home, near Katonah, N. Y., had a front yard about 500 feet long. In a pinch, that was enough space to take off. But trees at both ends were too high to clear. Worse, the yard ran downhill. Worse still, it had rolling grades of 12 to 25 percent.

Yet the trip between home and office took him 40 minutes by car. With a small plane he could make it in 8 to 12, depending on the wind. And today he does, summer and winter, whenever the weather is good.

These pictures show how he solved the problem of a front-yard airport—but it's a trick only an extra-good pilot could pull off!



Preparing to launch 85-hp. Aeronca Champion is. Bennett braces two wood blocks in landing gear and loops rubber shockcord around them. Tension on cord holds blocks in place.



Next step is to stretch the rubber cord to double its length by hooking it to bumper of family car and driving forward as the plane is held stationary by chocks under its wheels. Forward end of stretched cord then is hooked over a stake. Plane always takes off up hill.

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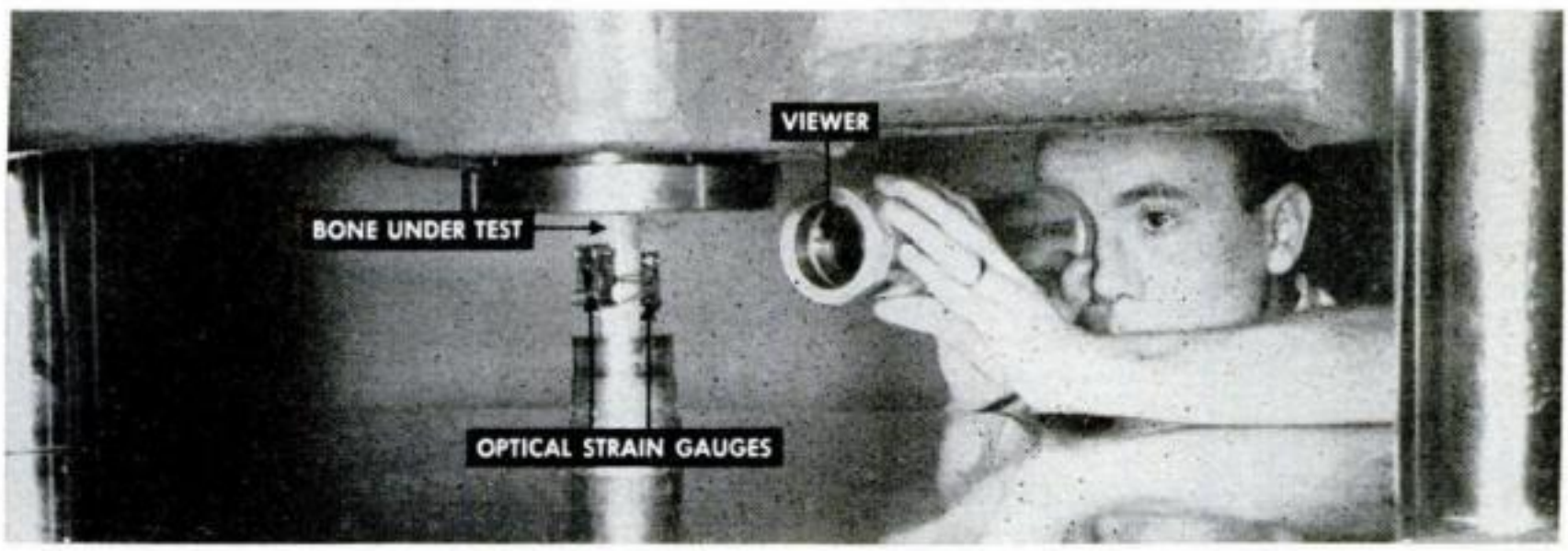


When chocks are jerked from under wheels, pull of cord helps engine flick plane into air in less than 200 ft. Release of tension on cord **then lets the blocks** drop from landing gear.



After taking off at 40 m.p.h., pilot holds the plane's nose down for a couple of seconds to gain more flying speed. Then he pulls up sharply just in time to clear the trees.

You're Tougher Than You Think



YOUR bones are twice as strong as hickory wood and 10 times as flexible as steel. So says the Navy, which has been testing human bones at the National Bureau of Standards in Washington with the apparatus pictured above.

A piece of bone, machined to cylindrical shape, is being squeezed in a hydraulic press. The operator peers through the telescopelike viewer to measure its shrinkage as the pressure mounts. The bone snaps at about 23,000 lb. per sq. in. Such tests will aid in designing safety devices for planes and ships.

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Station Wagon Glows in Light of Approaching Car

THERE's little chance of an approaching driver smacking into this station wagon at night. It stands out clearly in the light from another car because of a reflective sheeting applied over the wood paneling. Previously used on traffic signs and license plates for better night visibility (PS, July '48, p. 138), this sheeting now is available in several colors and can be printed to look like any surface. You thus can put it on any vehicle without changing the daytime appearance (inset photo). The sheeting, called Scotchlite ®, is an adhesive plastic film impregnated with tiny glass beads that reflect light back to its source without glare. It comes in rolls, like wallpaper.



Mask Sharpens His Aim

THIS practice mask sharpens a football passer's target eye by making him pick out a receiver at a glance. The inventor, Prof. Hoyt L. Sherman of Ohio State, here shows how a tug on a string lifts the face flap to give Quarterback Pandel Savic a fleeting glimpse of his field. As the flap drops, Savic must throw without a second look.



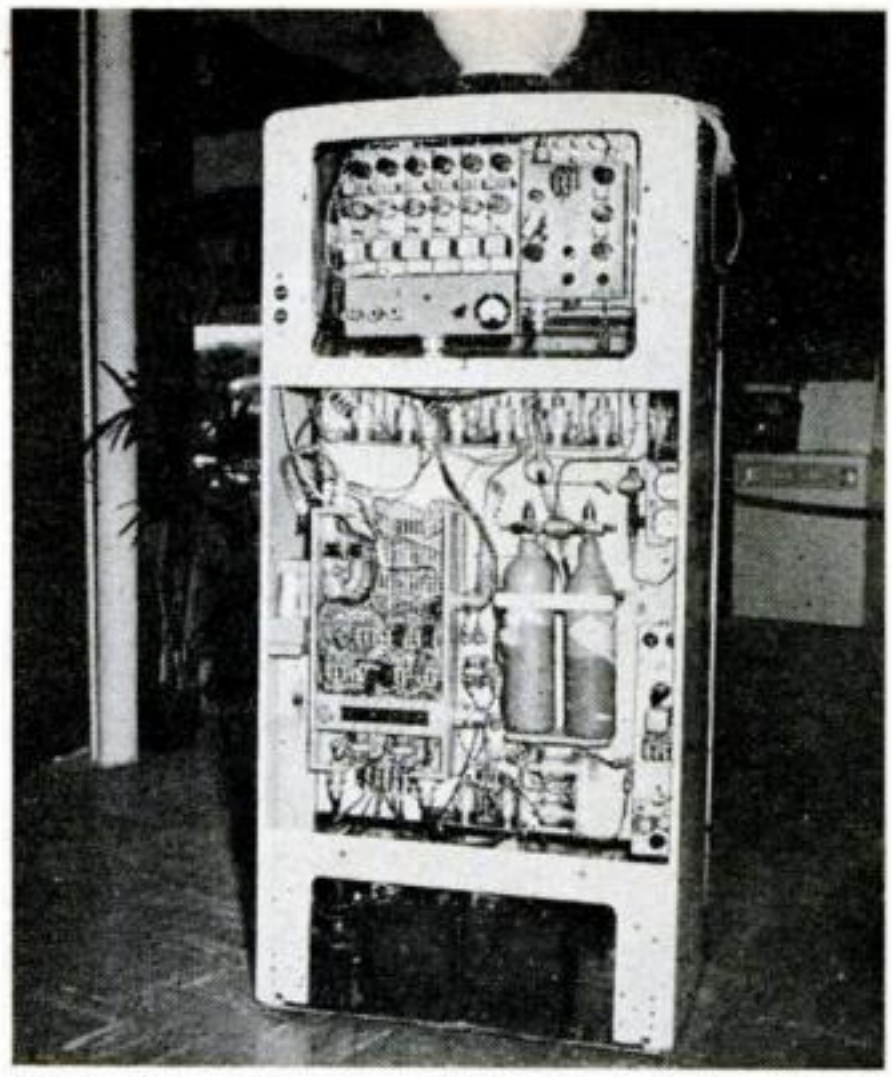
Fork Prong Saves Back

BILLED as a lazy-man's spading fork, this new garden tool was displayed recently at an inventors' exhibition in Paris. A spring-and-roller hinge holds its metal prong against the ground while the fork is pushed into the earth. The prong then serves as a fulcrum on which the fork handle operates as a lever to pry out a bite.

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Junior, the talking refrigerator, amuses the patrons of a St. Louis department store. Junior can walk, dance, open and shut doors. His bow tie also lights up—for pretty girls only.



Junior's works are visible from back. Radio receivers are at top. Bottles below contain compressed nitrogen that opens and closes doors. Batteries at bottom furnish the electric power.



Technician at hidden console is Junior's voice and brain. Dial under right hand controls doors. Earphones report spectators' remarks picked up by microphone concealed over the display.

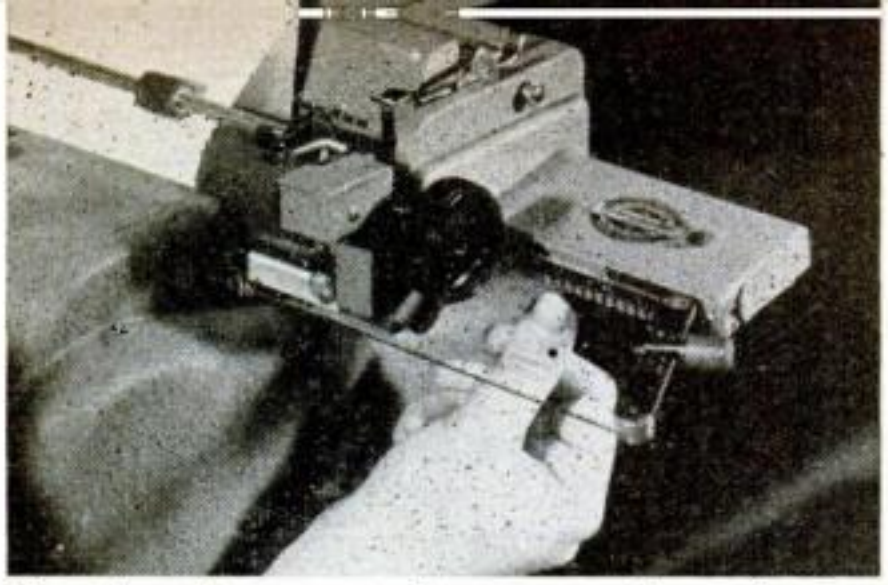
Trick Refrigerator Talks

IF YOU'RE looking over a refrigerator in a store some day soon, and its doors fly open and its shelves slide in and out while it says, "Hiya, bud"—don't run or even walk to the nearest exit. That's just Junior.

Junior is General Electric's talking refrigerator, now on a tour of home appliance displays. Except for his big rubber head, he looks like a standard box. But he can talk, open his own doors, and even waltz.

The one thing Junior can't do is keep food cold. His freezing unit has been replaced with seven radio receivers, several motors and electronic devices, a loudspeaker, and a system of solenoid switches. An operator at a console concealed nearby furnishes Junior's voice and pushes the buttons that put him through his paces. END

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Margin aligner attaches to carriage of most standard typewriters. Here, cord on roller at end of justifying lever is threaded through a notch numbered for column width you want.

Typewriter Slips On Purpose

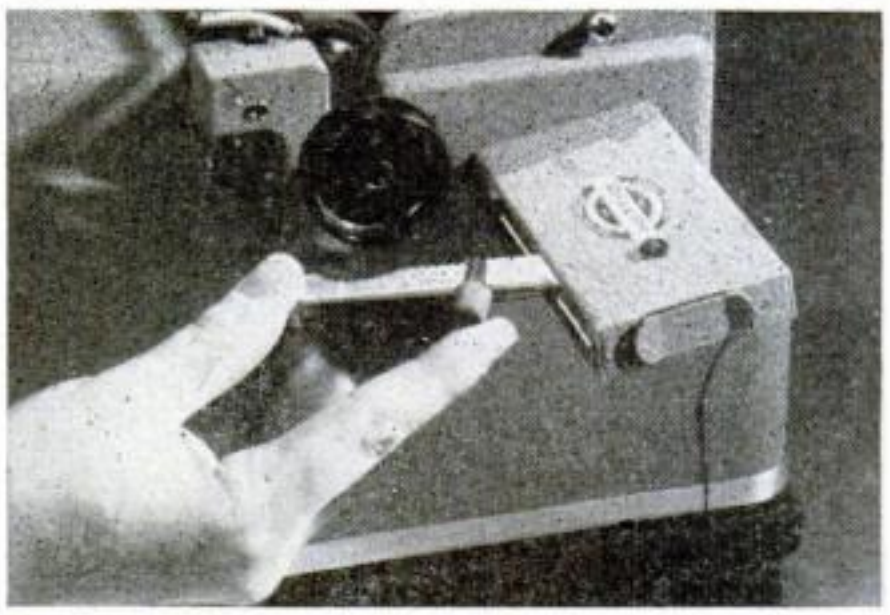
NOW you can type copy with an even right-hand margin—handy if you want to reproduce it by photo-offset—right on your regular typewriter. This device, attached to the carriage, varies the space between letters and words to make each line the right length. It works by letting the typewriter carriage slip just the right amount each time a key is struck.

Copy is first typed to within four spaces over or under the desired width. The amount each line must then be stretched or shrunk is found by laying a transparent scale over the draft copy.

On a second typing, the Marginator ® is used. The column width for the entire piece of copy is first set by threading a cord through one of a row of notches. Then, for each line, the space indicator is set for the number of adjustment units needed.

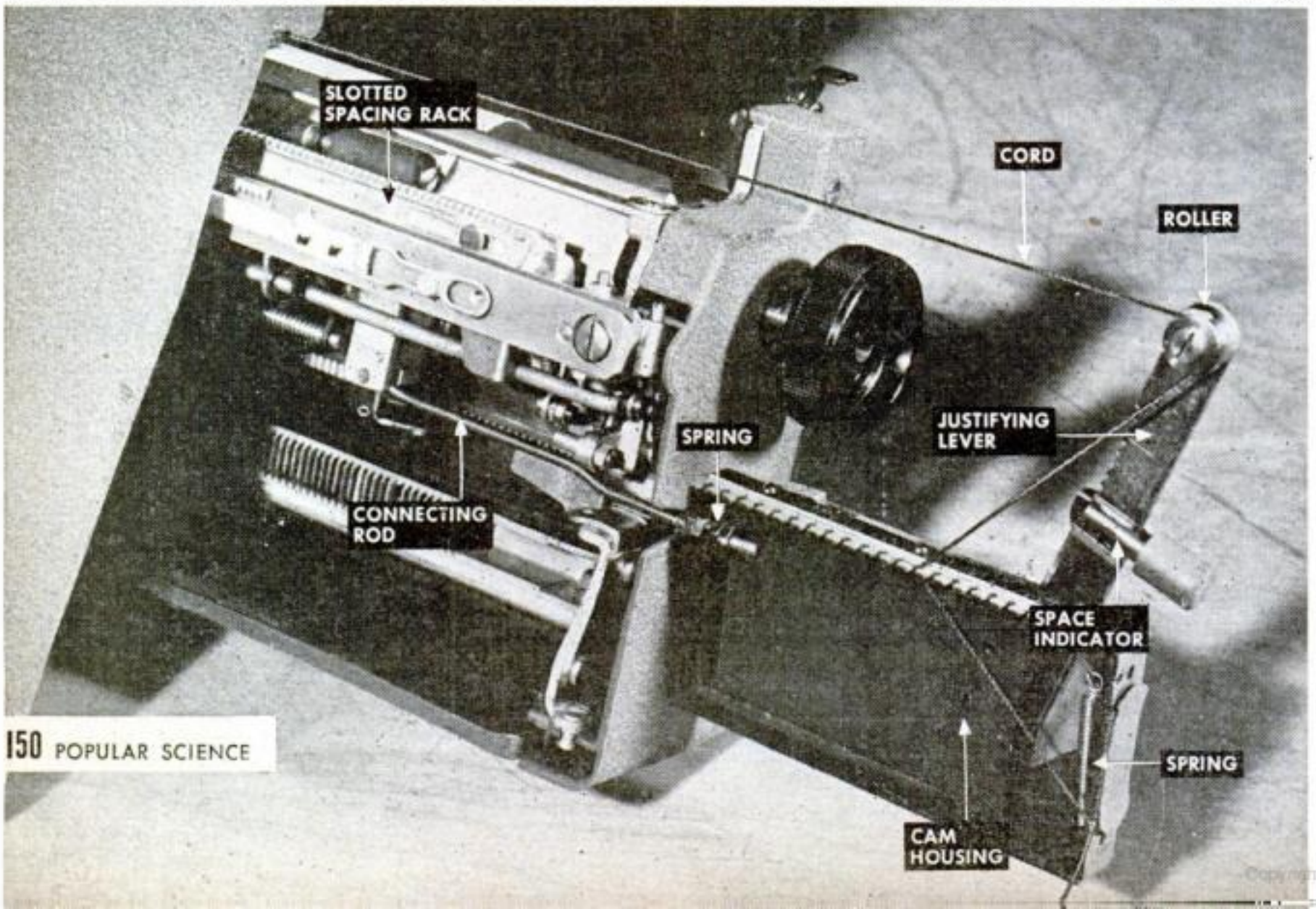
These two adjustments affect the movement of a cam, at the end of the justifying lever, that sets the tension of two springs. These springs govern how far the toothed spacing rack under the carriage will slip to the left or right in its slot during the typing of each line—and, thus, the length of the line.



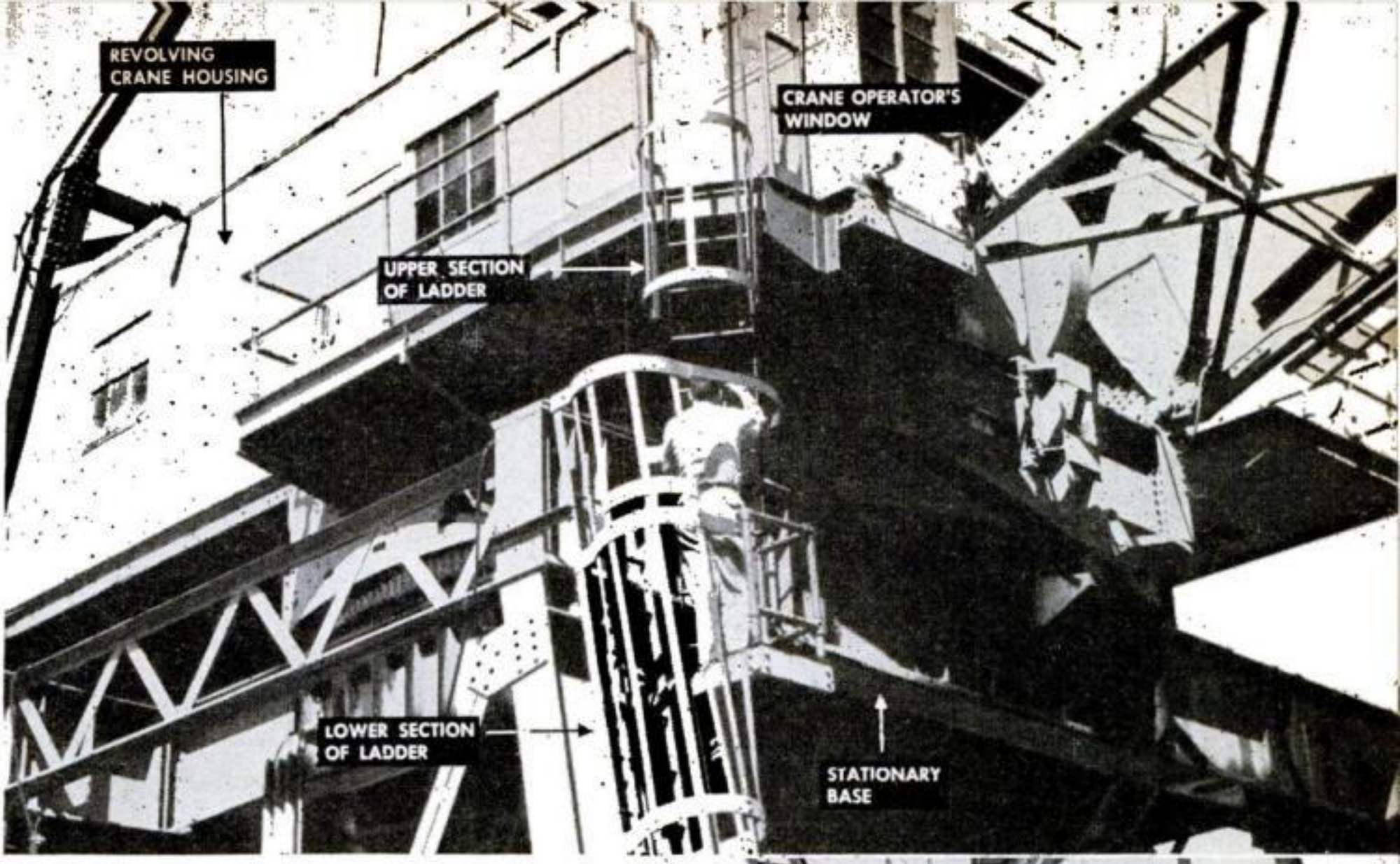


Second adjustment is made by sliding shorter lever to amount each line must be expanded or shrunk. You have already found this by measuring draft copy (top) with transparent scale.

View (below) of device from underneath shows how slot in spacing rack lets it slip sideways.

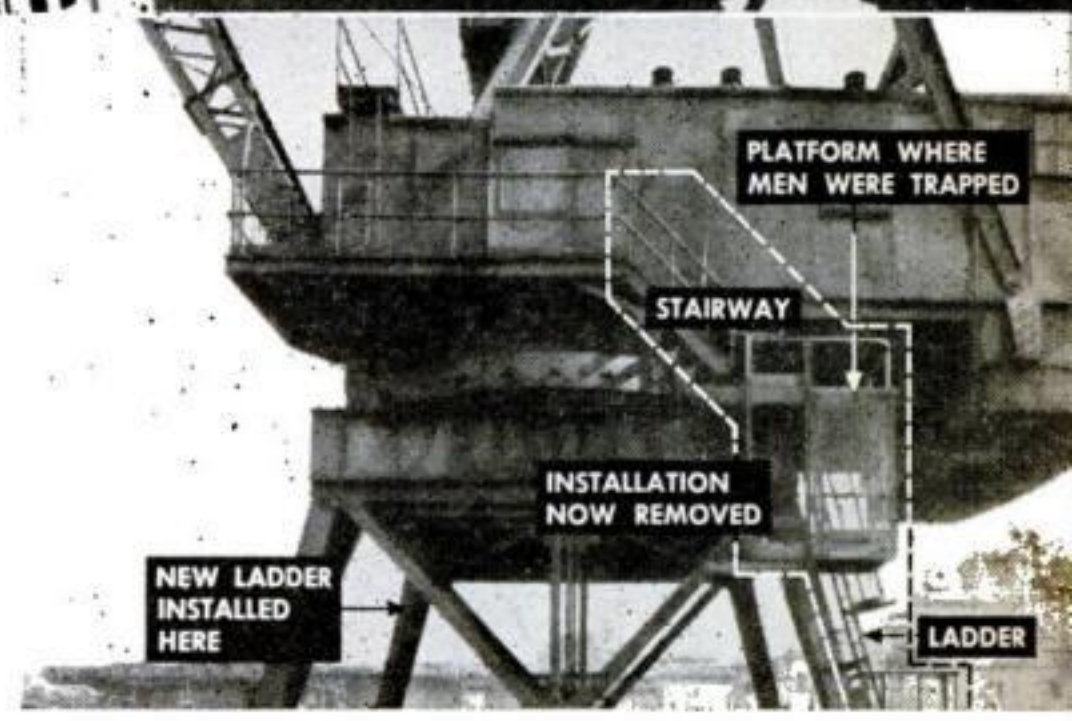


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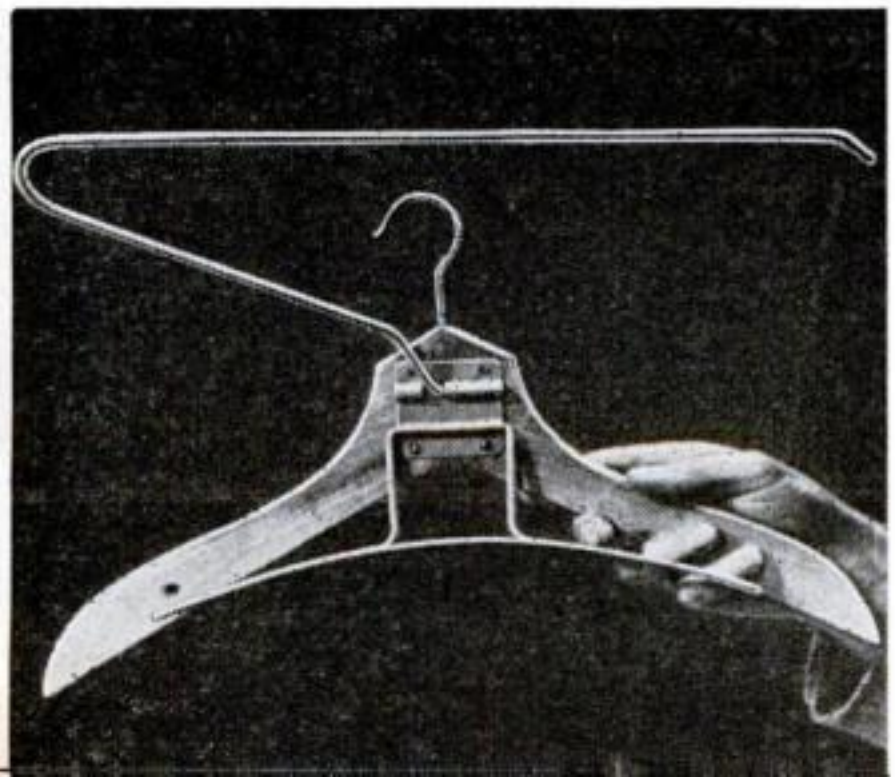
Crane Gets Safe Ladder

THE workman in the picture above is climbing into a 25-ton Navy crane on a new safety ladder. One caged section is attached to the crane's stationary base; the other, to the revolving housing. The man can mount from one to the other only when they are aligned and in sight of the crane operator. This ladder replaces the installation shown at right. With that, several men had been injured when the crane swung against them while they were trapped between the lower ladder and upper stairway.



Hangs 3-Piece Suit in 1

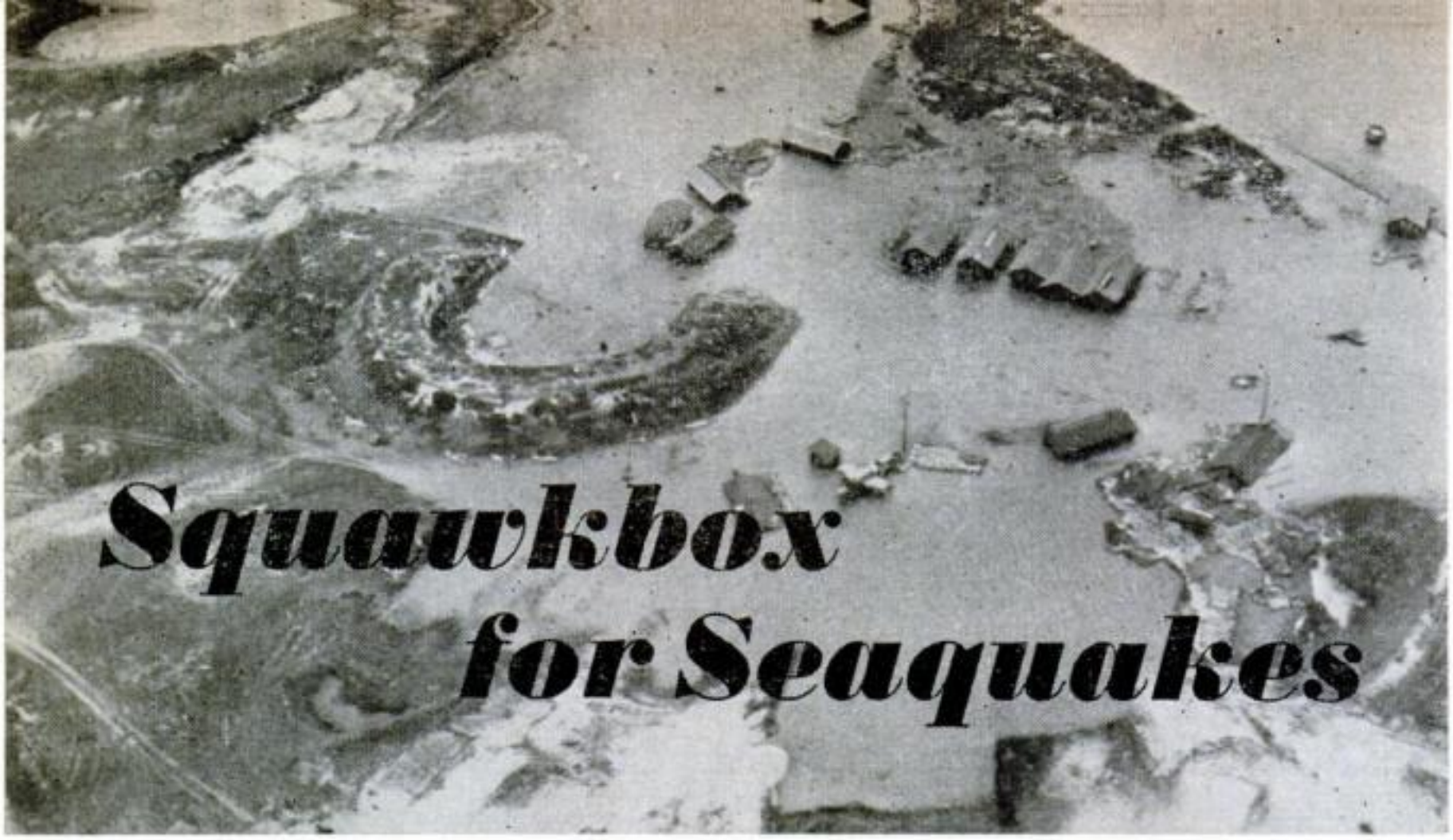
A NEW British clothes hanger, shown below, solves the problem of how to hang your trousers on the same hanger with your vest and jacket without knocking them off. Its separate rods for both the vest and trousers simply lift up until you need them in the natural order of undressing.



Mop Scrubs and Rinses

THIS garden-hose attachment (below) speeds washing a car or windows by rinsing as it scrubs. The mop can be replaced with a jet spray for sluicing sidewalks or a pressure breaker for irrigating plants without stooping. The complete set, called Prac-ti-cal Water Sweeper ®, sells for $2.95.

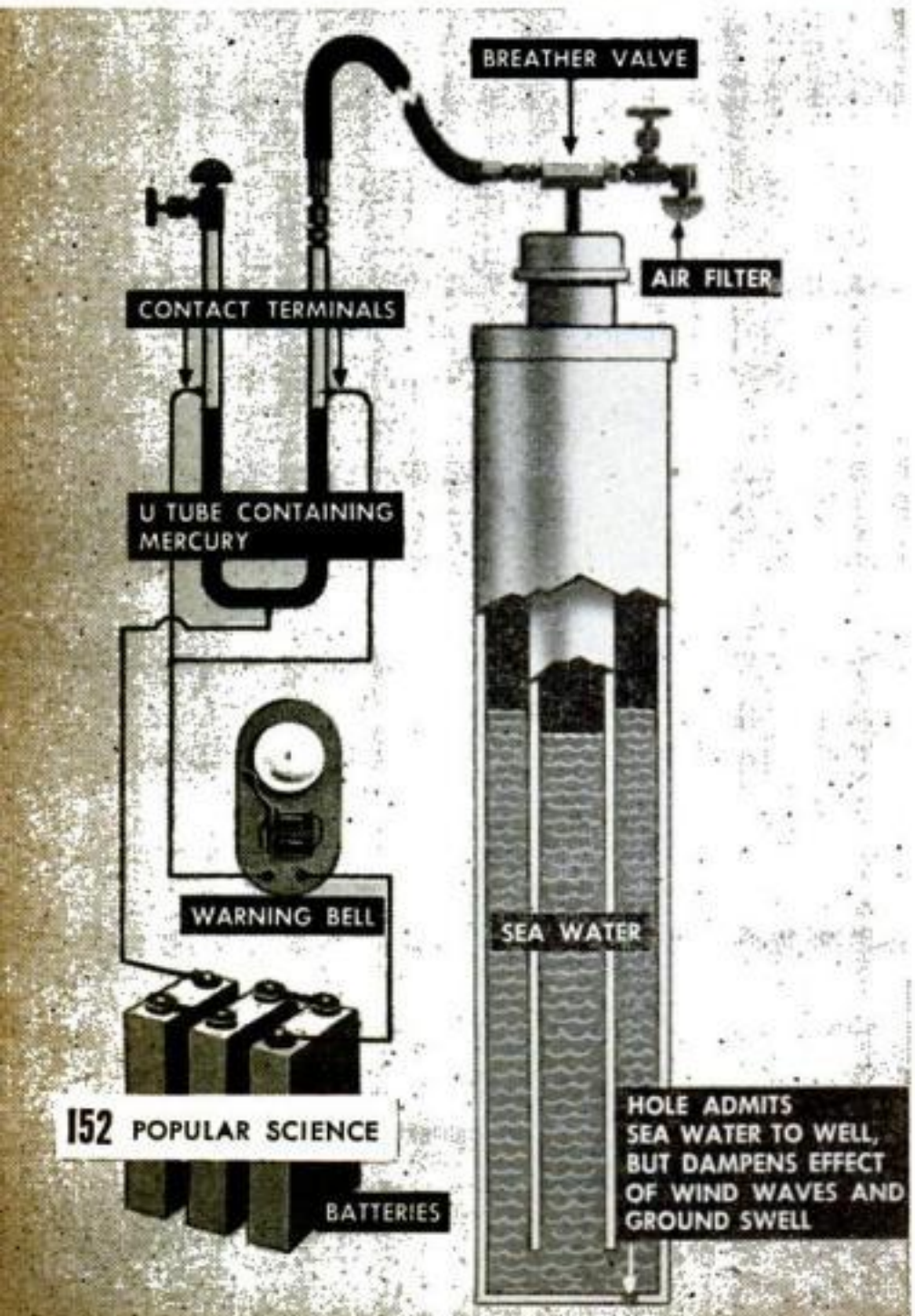




Squawkbox for Seaquakes

ON APRIL 1st, 1946, 54-foot waves swept in without warning on the Hawaiian Islands. When the waters withdrew, as shown above at Kahuku airfield, they left 173 dead and $25,000,000 damage.

Sketch below shows how sea-wave detector works. Air pressures slowly built up in the well by normal tides escape through tiny breather valve. This valve cannot handle pressures caused by the comparatively rapid rise and fall of water level characteristic of seaquake waves. Thus blocked, these cause a rise and fall of mercury in U-shaped tube, sounding alarm when terminals make contact through mercury.



Such huge waves are caused by earthquakes in the sea floor. Racing across the open ocean at 600 m.p.h. the seismic waves flatten out so that they pass ships and aircraft unnoticed. Only when they hit shallow water do they rear up—and smash down.

Now, however, the U. S. Coast and Geodetic Survey is planning to spot these monsters at birth. First, seismographs, spotted at strategic Pacific points, will pick up any submarine quake. Coasts near the quake will be alerted by radio. In these areas the new wave detector at left will sound the alarm when the sea movement that runs ahead of the main wave is felt. This movement, in which the water rises several feet in a few minutes, frequently goes unnoticed, but arrives at least 17 minutes ahead of the quake wave. This gives people near the wave alarm barely enough time to run for the hills. Flashed to the earthquake center at Hawaii for broadcast, however, the warning gives exposed areas at a distance several hours to evacuate their coasts and send ships to sea before the death-bearing wave arrives.

This map of the Pacific shows where the warning detectors now under development might be installed. Such a system would alert the Hawaiian Islands hours before sea waves struck.





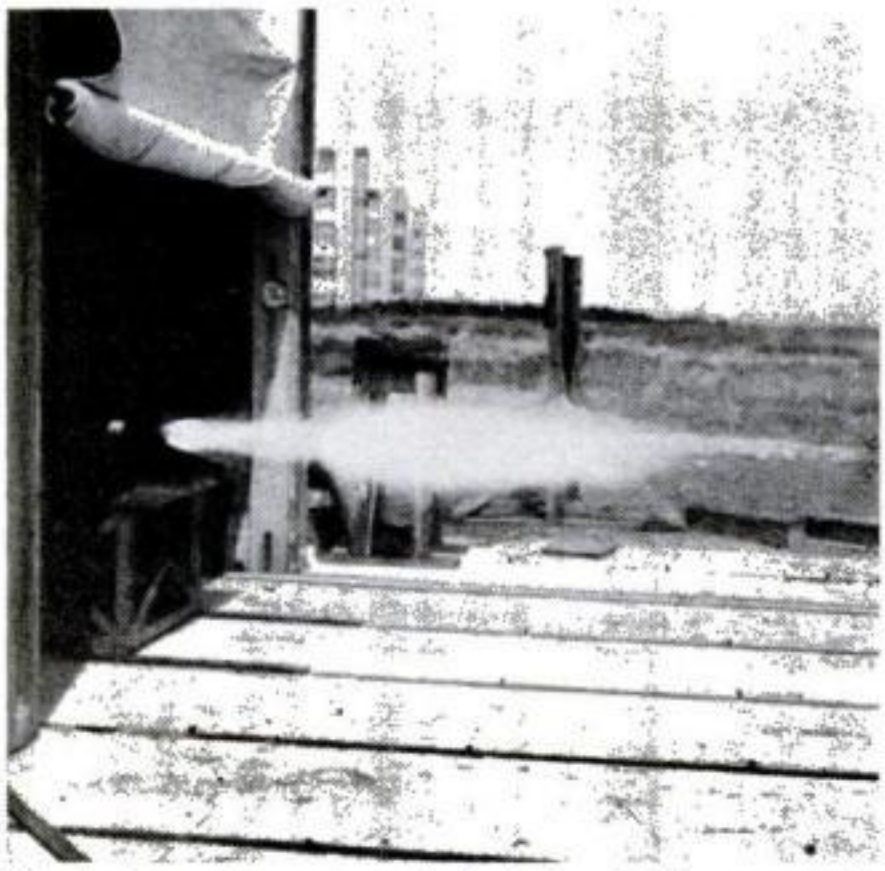
Navy's mobile laboratory unit takes instruments right out to pits where rockets are tested.

Lab-on-Wheels Speeds Rocket Tests

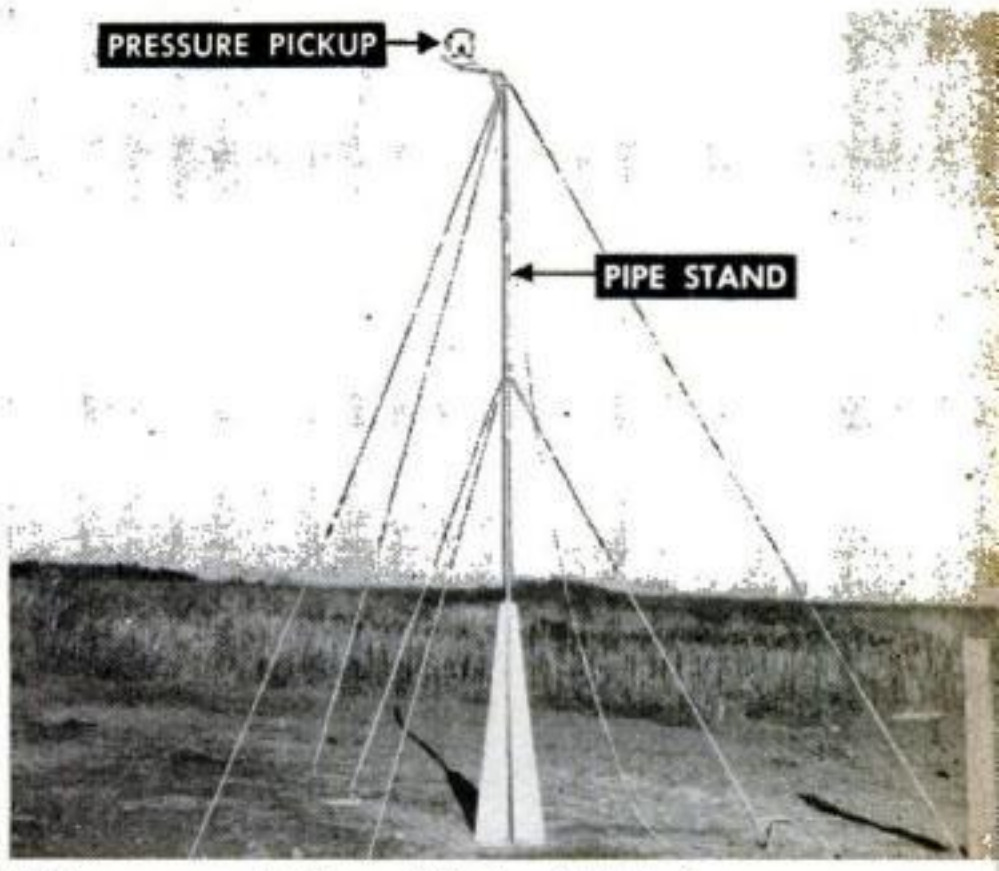
THE Navy can now take a complete laboratory right out to the rocket test pits. Inside a specially built truck and trailer, instruments and photographic processing equipment turn out a full report on rocket-motor experiments—within a few minutes after the firing is over. They start working at the push of a single button.

Because of the noise and danger, the test pits are generally located some distance from any permanent building. Previously, instruments were set up on the ground near the pits, and their records—usually on photographic film—had to be carried to the nearest laboratory before results were known. Now the whole job is done right on the spot, with considerable saving in time and effort.

The mobile unit, designed and built at the Naval Gun Factory, in Washington, now carries everything needed.

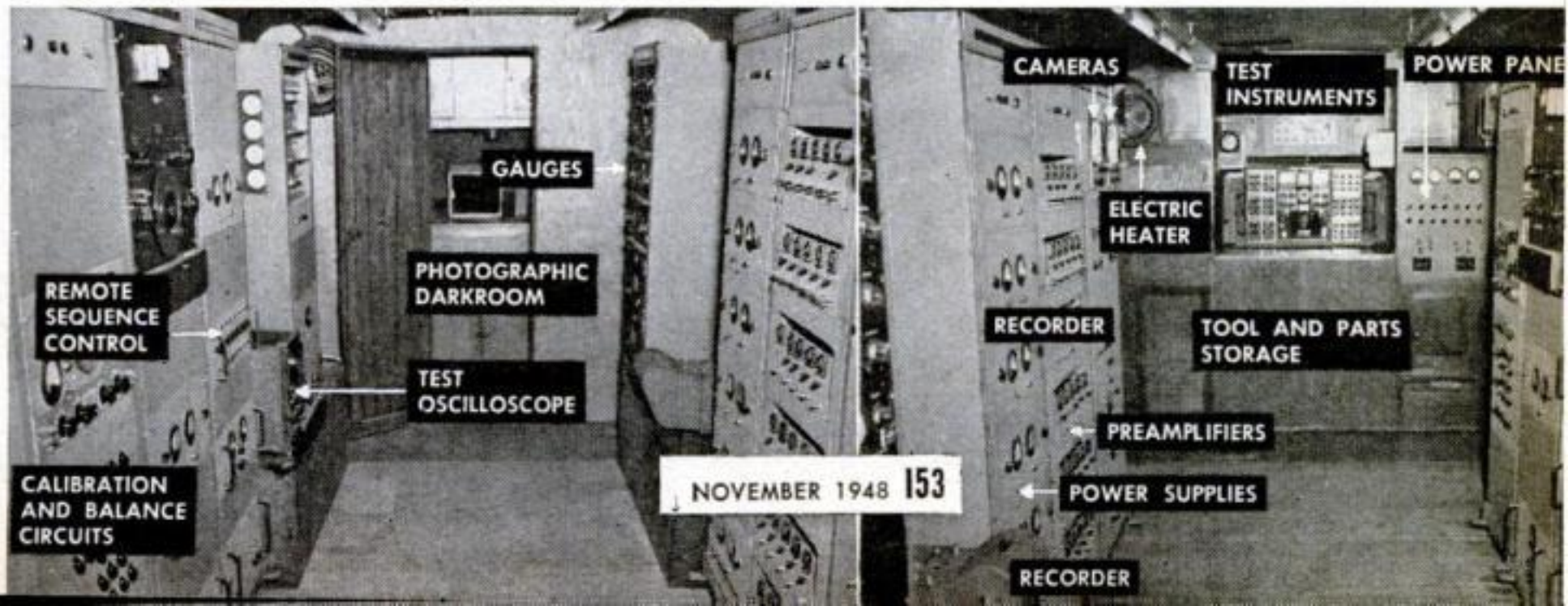


Rocket motors are tested in shelter or pits made of heavy concrete. The motor being fired above is held in a specially designed dynamometer, which measures its power output.



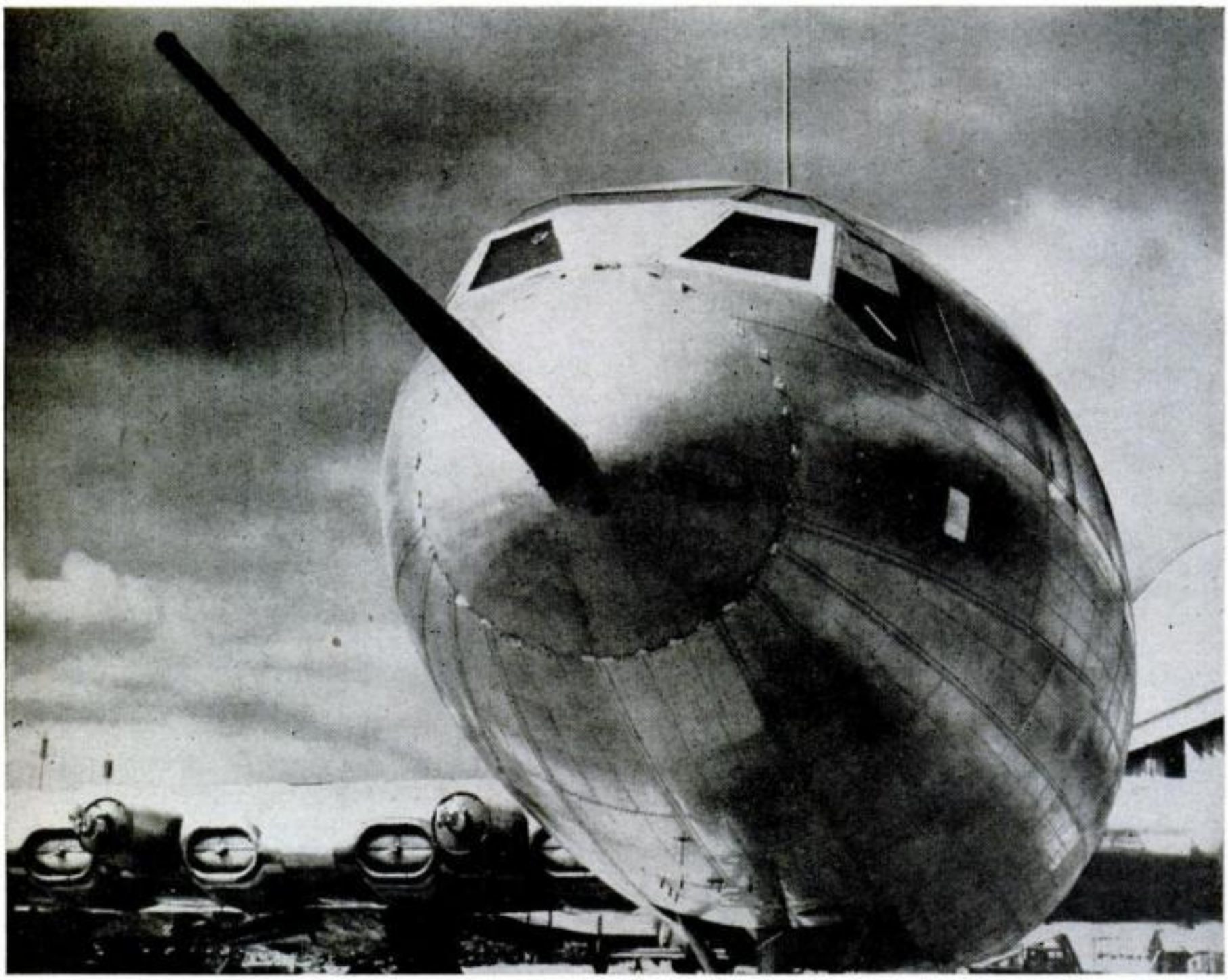
Pickup mounted on tall stand detects pressure variations at a distance from rocket flame. Other instruments measure temperatures, radiated energy, sound energy, shock waves, torque, etc.

Signals from dynamometer, pressure pickup, and other instruments are fed to multi-channel oscillographs inside trailer (below) and recorded on film. Films are developed in darkroom built in trailer. Results are expected to explain how to use gases to launch rocket, how to vent gases from the launchers, and how the rocket blast affects outer surfaces of aircraft.





Light Plane's Wheels Fold. Retractable landing gear, unusual in a low-priced plane, is shown in operation, at left above, as the new four-place, all-metal Atlas takes off. The plane also has a controllable-pitch propeller. Its large tail assembly increases controllability. The photo at right shows how large doors provide access to front and rear seats. The 170-m.p.h. plane sells for $2,995.

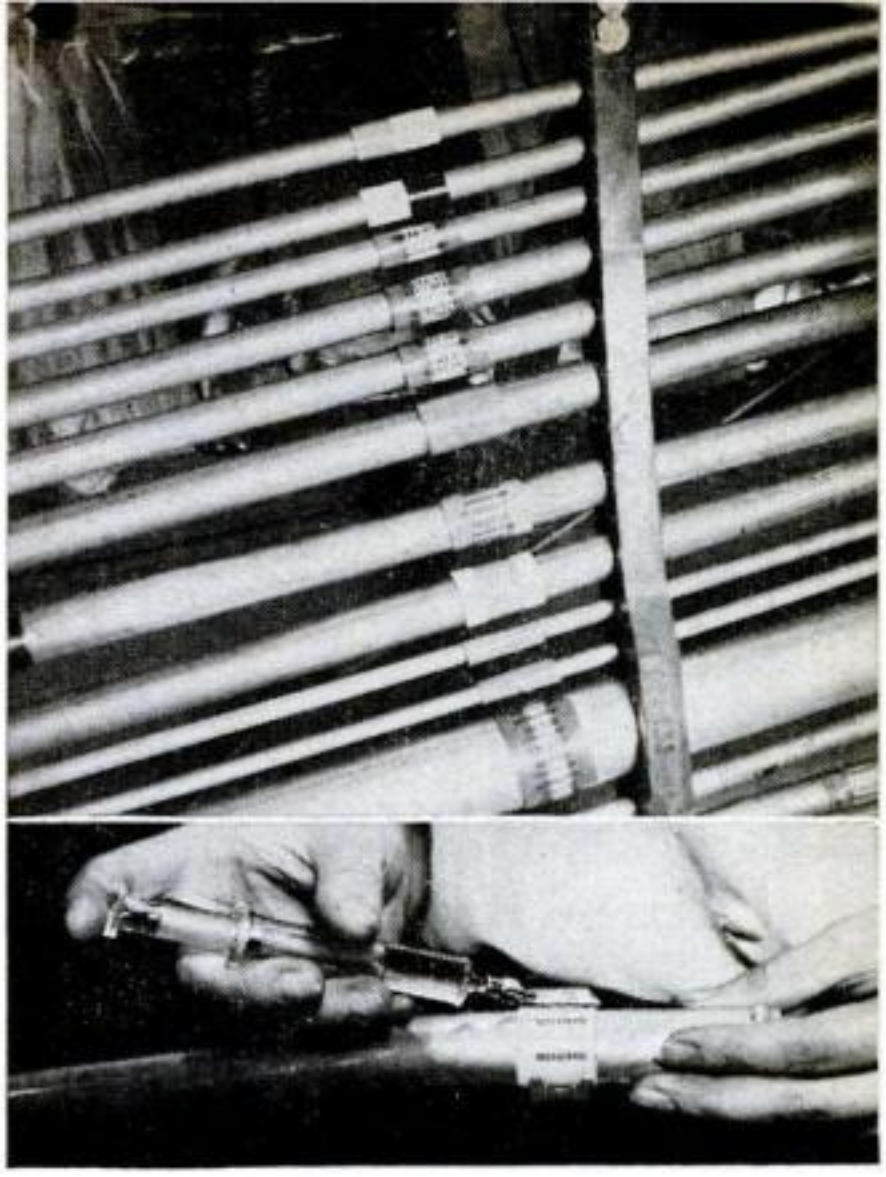


Meet Britain's Biggest. Out of its hangar for the first time, the 130-ton, $24,000,000 Bristol Brabazon I is nosed into position for calibration tests of its instruments. The land-based giant is 175 ft. long and has a wing span of 230 ft. Powered by eight reciprocating engines, it is scheduled to fly this month. Eventually, it is to have eight jet engines. The plane, one of two on order, will carry 100 passengers.

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Plane Snaps Shock Waves. As turbulences approaching the speed of sound rush through the air channel shown above on the wing of an F-51 Mustang, they interfere with parallel beams of light. The resulting patterns are photographed by a camera in one of the fairings forming the channel. By using this adaptation of Schlieren apparatus, NACA engineers at California's Ames Aeronautical Laboratory hope to learn more about making airplanes fly faster than the speed of sound.



Tubes Marked Permanently. This tubing installation, buried inside a modern commercial plane, shows each tube identified by a new permanent plastic sleeve. It was developed by the Glenn L. Martin Co. to replace an adhesive that sometimes softened and came loose. Colors of the sleeves indicate contents of tubes; printing on them tells the direction of flow and where it goes. The bottom photo shows a worker sealing one of the new plastic sleeves with acetone from a hypodermic needle.

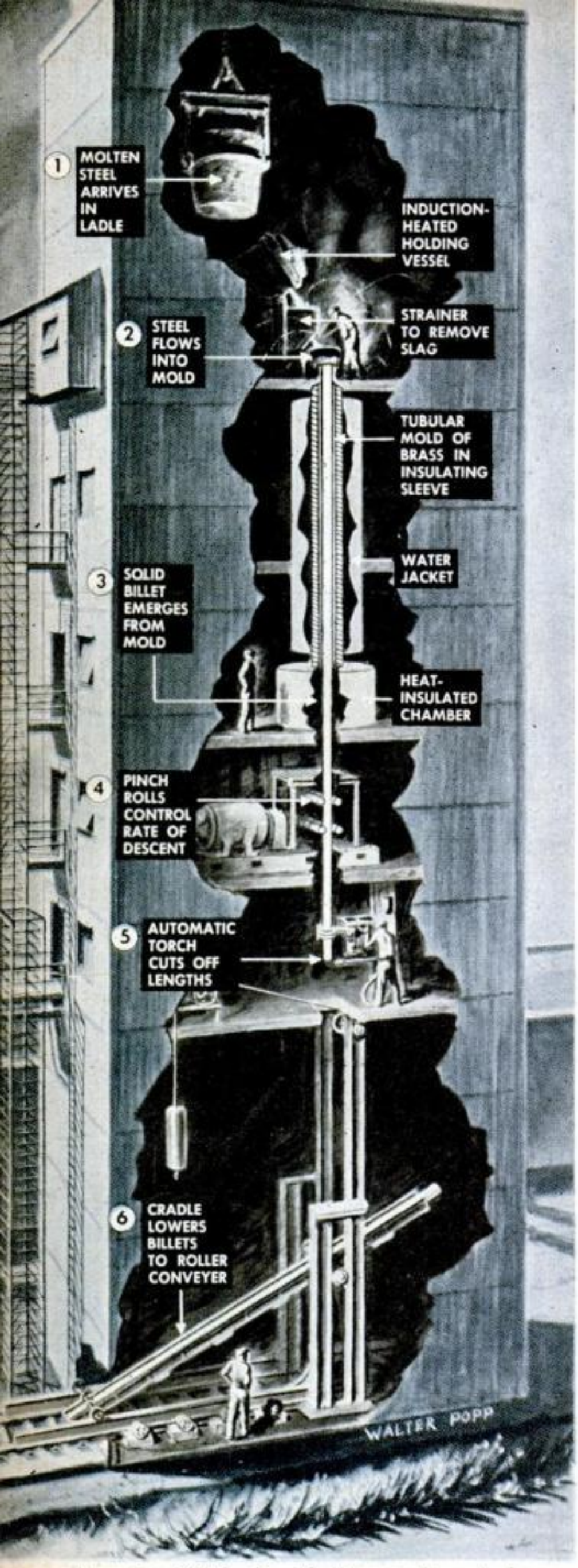


Tilting Wings Aid Flight. Faster take-offs and slower landings are made possible by a wing-root pivoting device that tips up the wings of this British Vickers Viking Seagull amphibian. For cruising and high-speed flight, the wings are returned to their normal angle. Designed for spotting, training, and air-sea rescue, the plane is powered by a Rolls-Royce Griffon engine that drives counter-rotating propellers.



Tank Serves as Fire Truck. Completely equipped for fire fighting and rescue work, this remodeled tank carries grappling hooks to drag fuselages out of flaming gasoline, pneumatic saws to cut through metal, and foam-fog spray to protect personnel in burning planes. Other equipment on the vehicle, developed by the Air Force's All-Weather Flying Center, includes searchlights and two-way radio.

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Forming billets directly from molten steel, continuous-casting machine in 75-foot tower makes light work of a task that has required the heaviest machinery of the steel industry.

New Machine Simplifies Steel Making

A RADICAL new machine in a little six-story building at Beaver Falls, Pa., recently filled its first commercial order—45 tons of steel billets.

It turns molten steel, for the first time, directly into semifinished shapes. When they leave the mill, they are ready for conversion, by light rolling, into sheets, pipes and tubes, plates, bars, or wire.

For small-scale steel making, traditional steps that require the steel industry's mightiest machinery are eliminated. There's no pouring ingots weighing several tons apiece; no heating them in "soaking pits"; no sending them crashing through the rolls of monster blooming or slabbing mills to knead them to shape.

Thus is realized a century-old dream of steel makers—continuous casting. It has been only a dream up until now because of the nature of steel itself: the high heats required, the tendency of slag to mix with the metal, the erosion of the equipment. After six years of research, Republic Steel and the Babcock and Wilcox Tube Company say they have licked the problems.

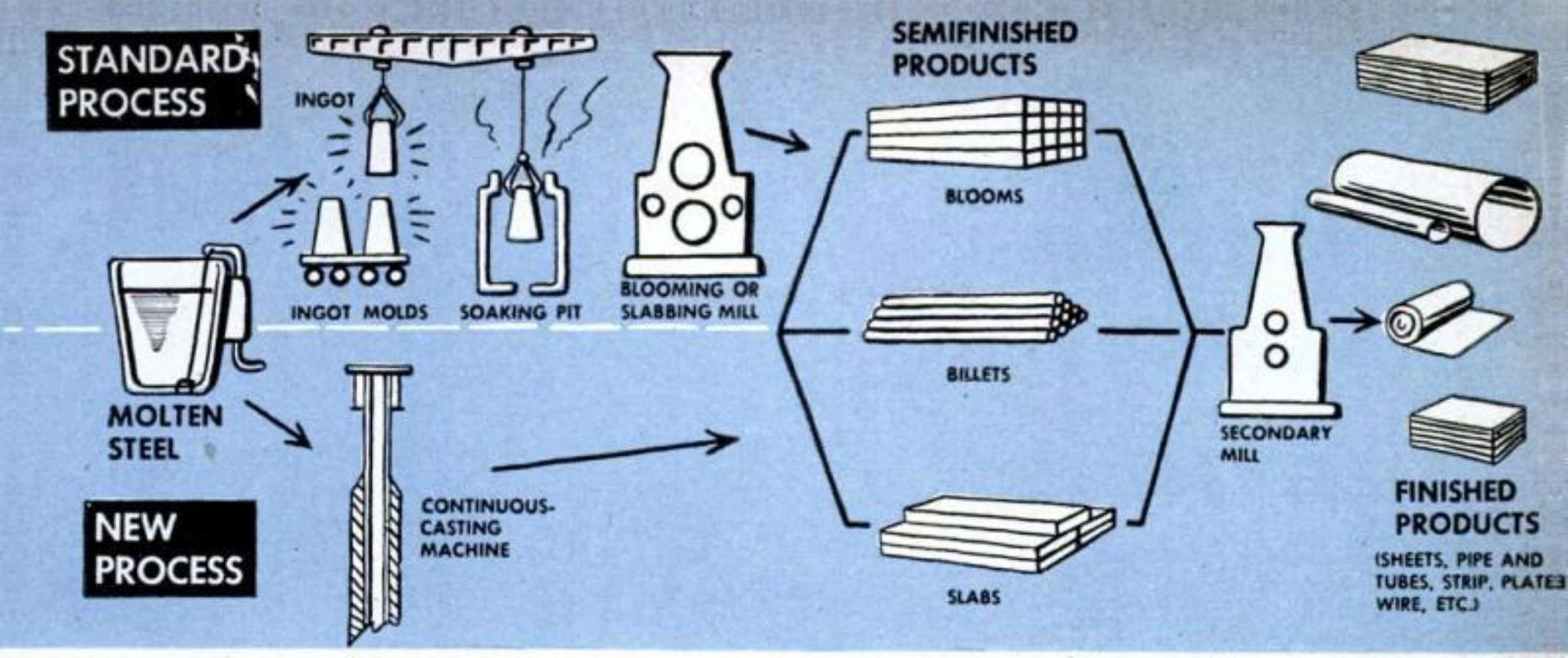
They have found a way, for example, to regulate the cooling rate in the mold more precisely and have introduced argon gas above the liquid metal to prevent oxidation.

The new machine is actually a vertical production line. Molten steel from the company's regular electric furnaces travels in a ladle to the top of the tower. There it is emptied into a holding vessel heated by electrical induction, then pours into the open upper end of the tubular mold.

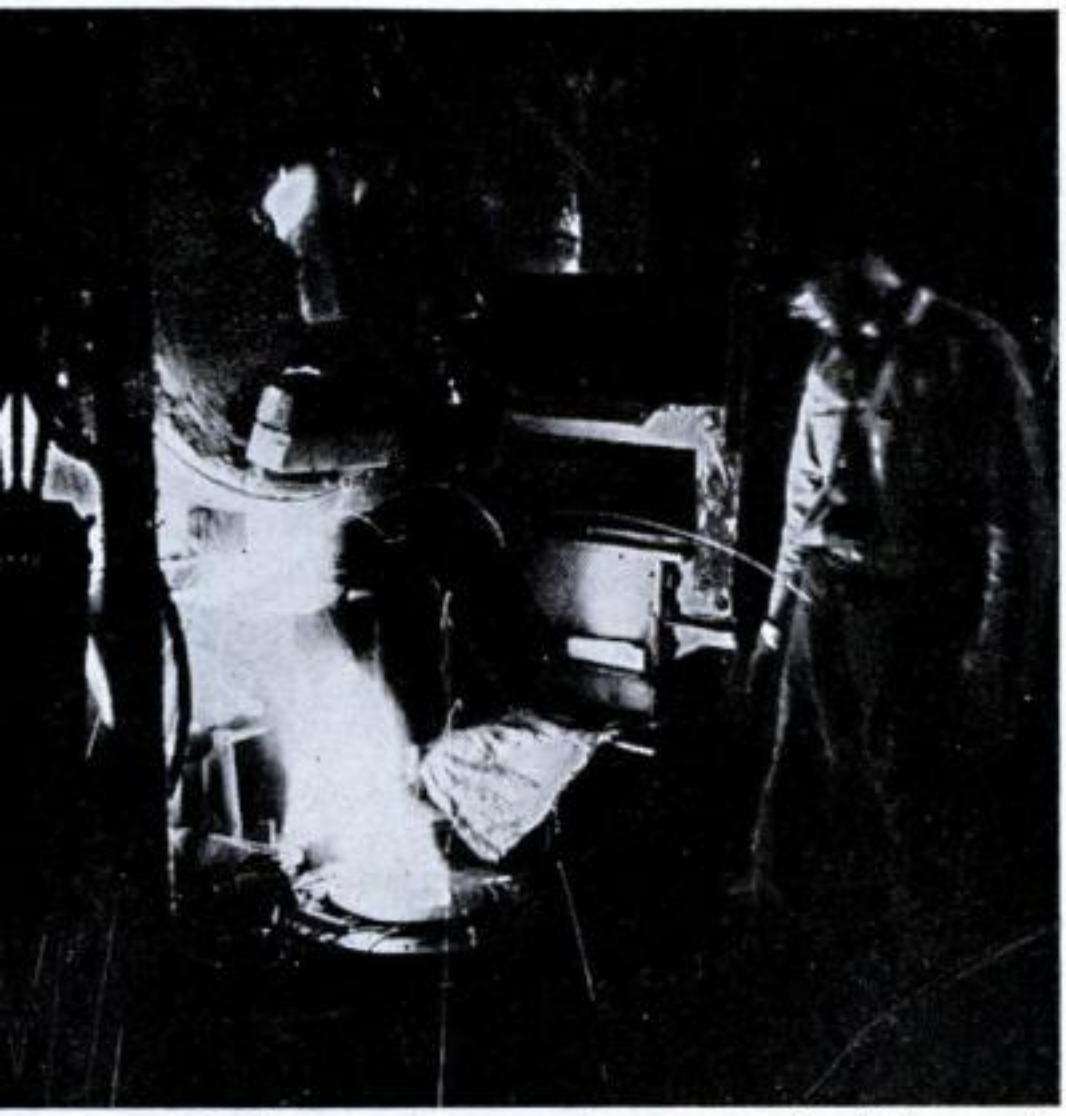
Descending through the water-jacketed mold, the metal emerges at the bottom as a solid stick. This is sized and drawn downward at a controlled rate by pinch rolls. Finally an automatic torch cuts the cast stick into uniform lengths.

Using the new process, little plants can now produce steel billets and slabs on a small scale at low cost and capital outlay—decentralizing the industry and adding their output to that of Big Steel.

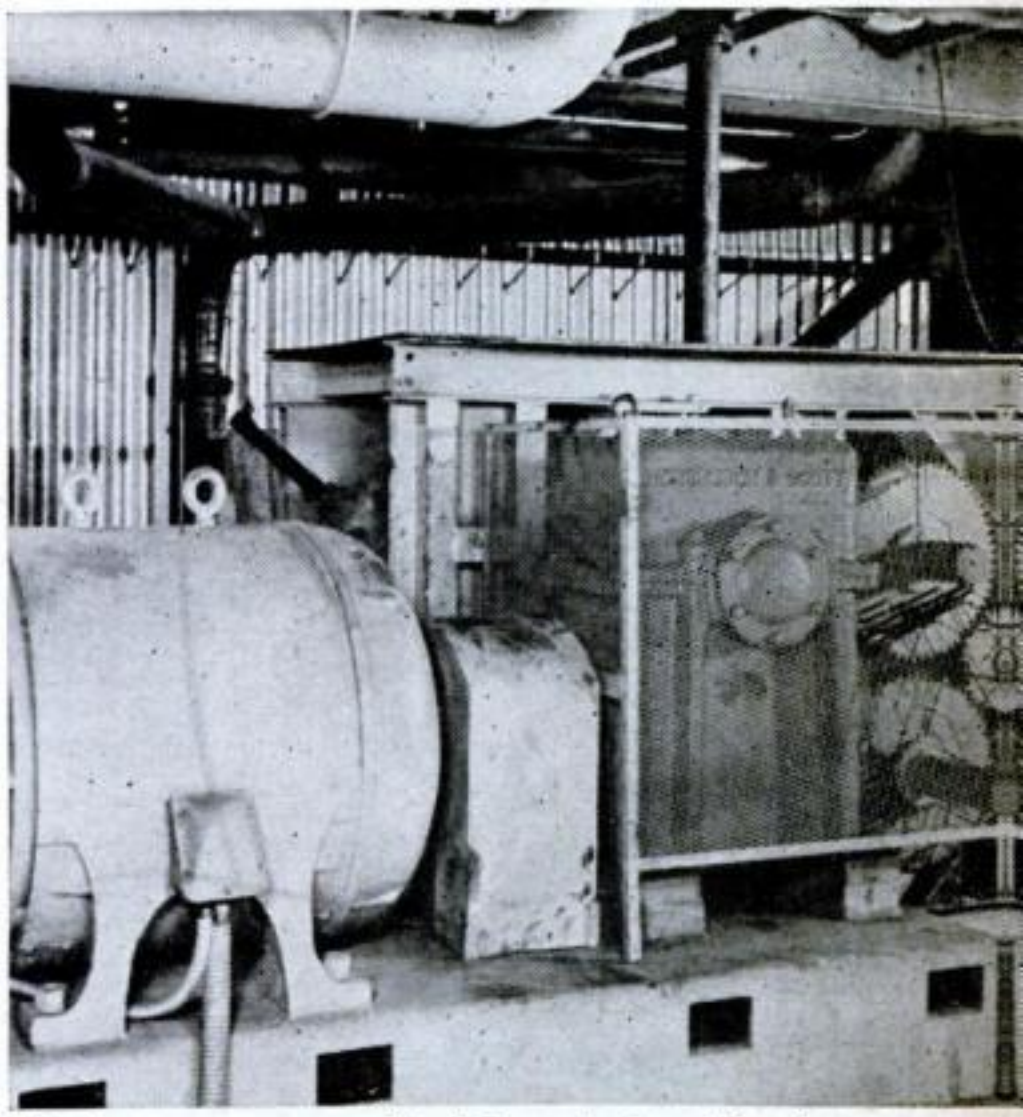
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Casting massive ingots, "soaking" them in heat, and shaping them in steel industry's mightiest mills, are steps eliminated in new short-cut method, contrasted above with old



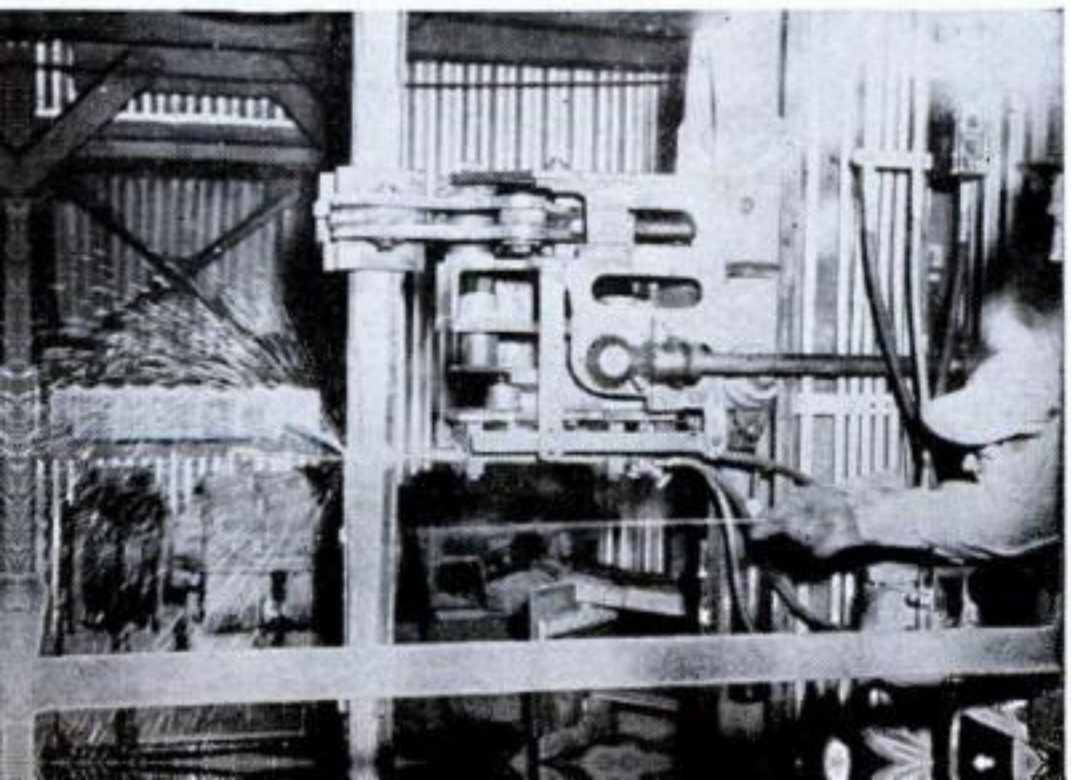
Molten steel pours into top end of the vertical mold. A solid billet will emerge from bottom end of mold. *(Photo from Iron Age.)*



Motive power supplied by pinch rolls draws solidified billet, seen in upper background, from lower end of tubular water-cooled mold.

Acetylene torch automatically cuts off billets in easy-to-handle lengths up to 35 feet. A cradle lowers them to horizontal position.

Typical billet of oval cross section, easy to roll into a "round" or a "flat," is shown below resting on a roller conveyer. *(Photo from Iron Age.)*



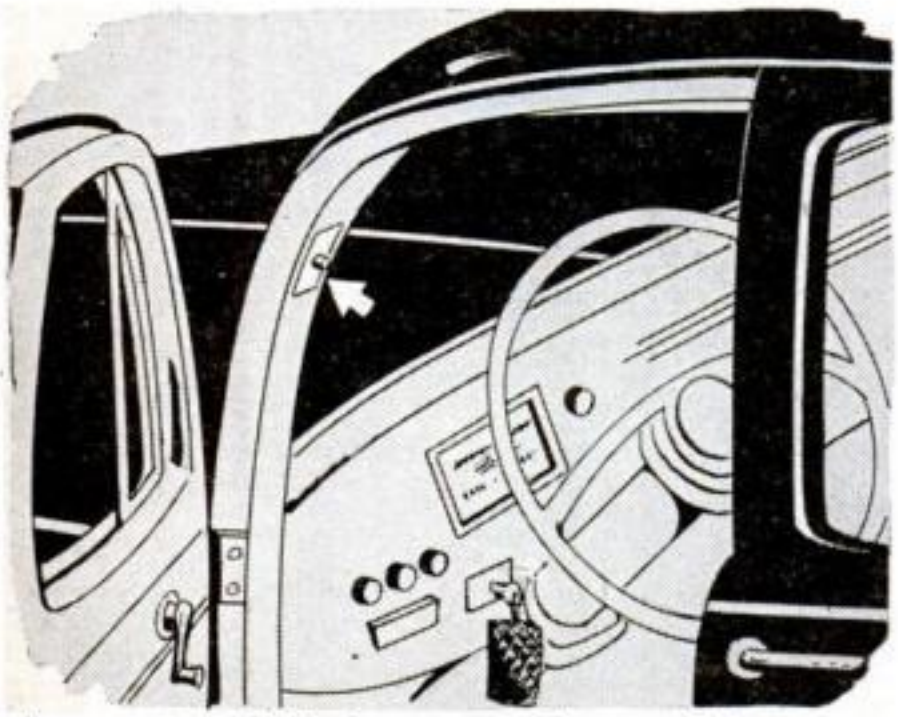


I'd like to see them make . . .

Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



Shower curtains with pockets. Many over-the-tub showers are built with only one soap holder. A flapped pocket on the curtain would hold other soap and a brush.—*Mrs. T. J. Bianchi, Elmhurst, N. Y.*



A warning bell for cars. This could operate off a switch set in the doorframe. If you got out to leave your car with the ignition, lights, or radio on, the warning would sound.—*Donald Smith, Belle Vernon, Pa.*



Fuel cans with transparent tops. If large oil and gasoline cans had clear plastic tops, you'd never have to worry about overflowing when you were filling them.—*Theodore Kapka, Chicago, Ill.*



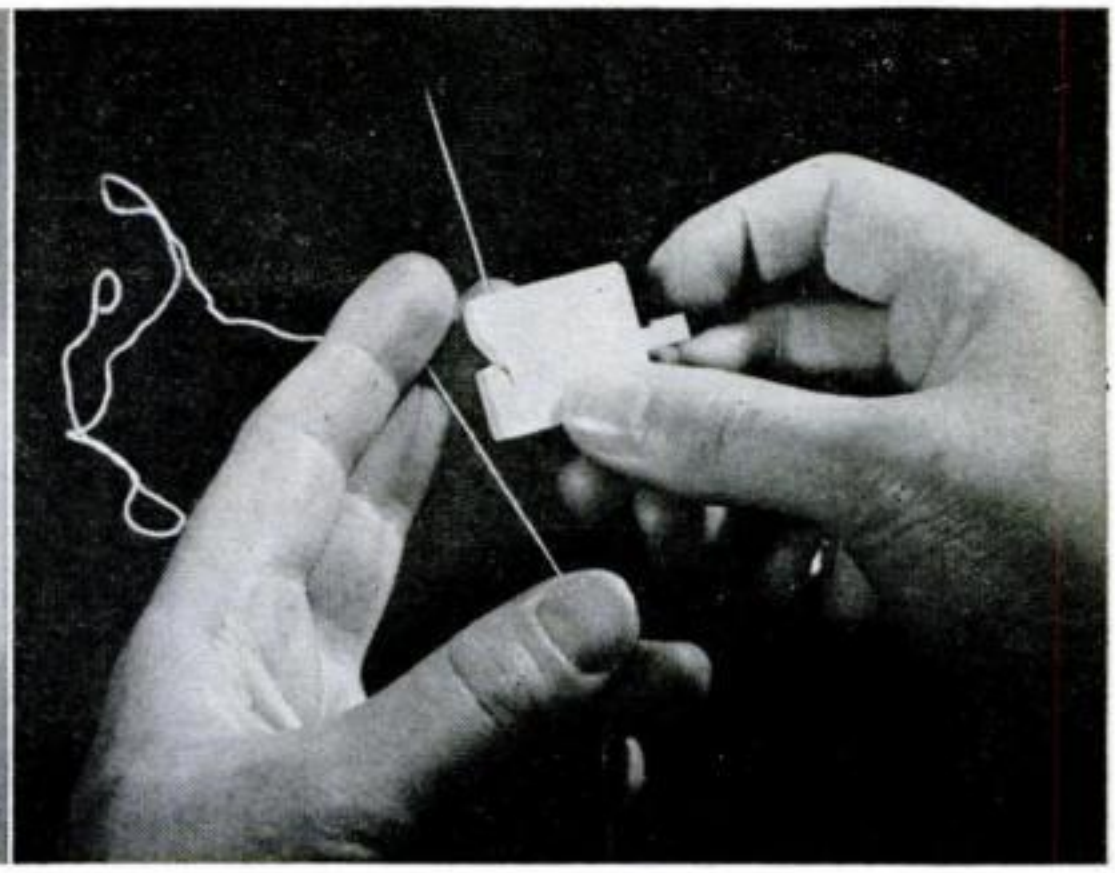
Telephones with pencil holders. Telephones could be made with a groove down one or both sides to hold pencils. Then a pencil would always be handy when and where you needed it. —*James Wilson, Manhattan, N. Y.*



Finger guards for housewives. Slip-on guards of light leather or plastic would save a housewife's fingertips when she has to use the grater for fruits, vegetables, or other food.—*Mrs. G. Olshenske, Pittsburgh, Pa.*

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Needle Threaders Save Eyesight and Tempers

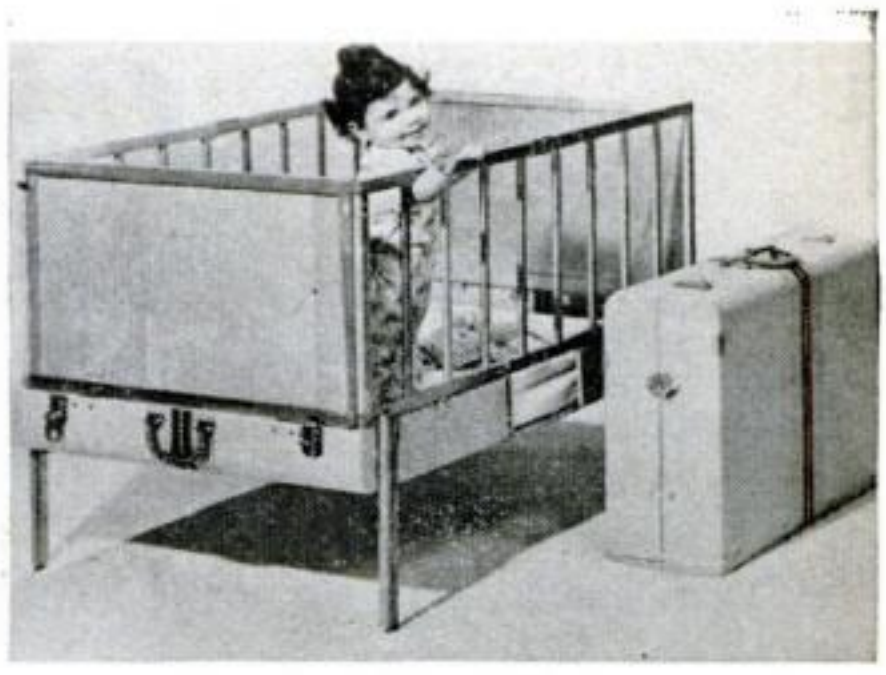
ANY man who has ever sewed on a button knows that the toughest part of the job is getting the needle threaded. That's easy now, with one of these new devices to do it without strain on your eyes or temper.

The essential parts of both threaders are a hole into which the needle is dropped with its eye down, a slot to slip the thread into, and a tiny hook that reaches through the eye and then pulls the thread through as it is withdrawn.

The threader shown at left above, made by the W. C. Burroughs Co., of Wilton, Conn., measures 3 by 3¾ by 3 inches, and has a sharp-edged piece of metal at the side for cutting a length of thread off a spool. Its hook is operated by pushing a button.

The threader at right above, only 1 1/16 in. by ⅞ in., has its hook on the end of the push-pull lever seen near the right forefinger of the user. A. E. Edwards, Inc., of New York City, makes it.





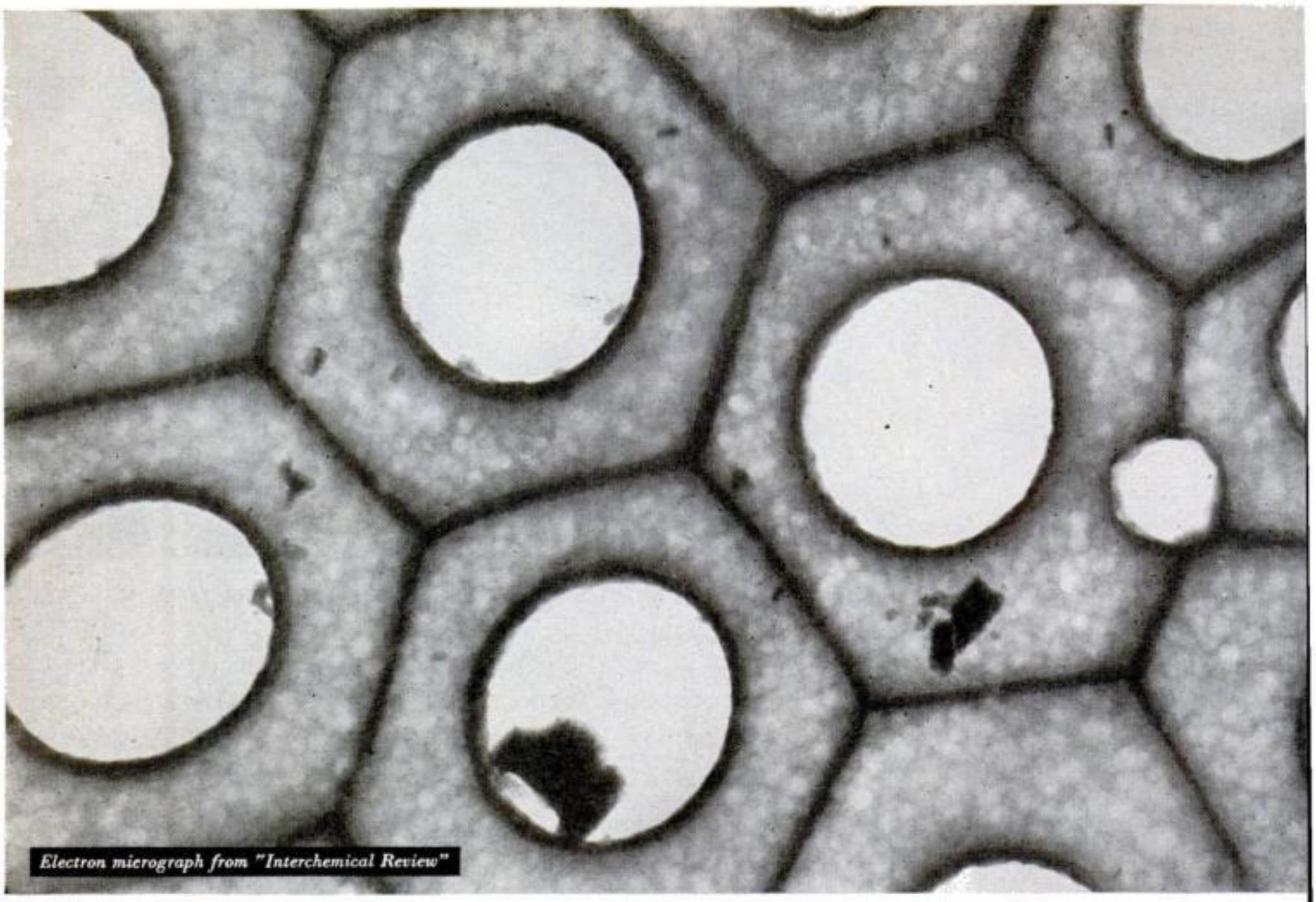
Folding Cribs Ease Traveling with a Child

EITHER of these two portable cribs simplifies the problem of taking Junior with you on overnight trips. Both can double as play pens as well as beds.

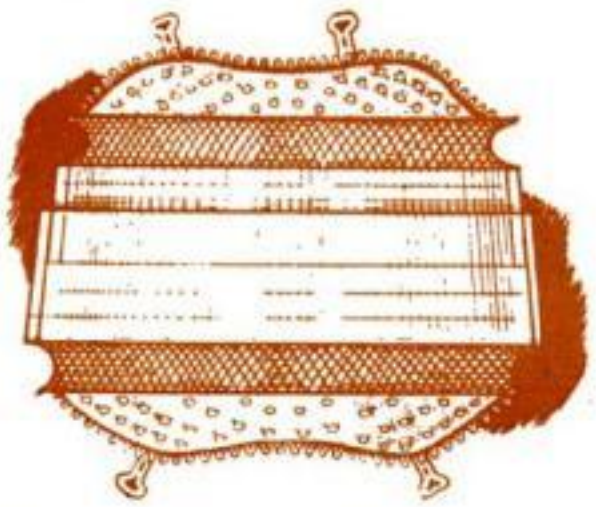
The Sleepy-Tot ®, shown at left, is nothing more than a frame with hooks and adjustable straps to hold it to any bed. Hinges at the corners and in the center of the end frames let you fold it flat by pushing in the ends. The straps then make a handle by which you can carry it with one hand. The crib weighs only 8 lb. and retails for $10.95.

The Travel Crib ®, above, opens out in 45 seconds from a 29-in. suitcase (right). The carrying case then forms the bottom of the bed and supports a mattress 48 in. long and 29 in. wide. For use as a play pen, the crib is lowered to the floor by folding up the legs. Made of plywood, with locking catches, it sells for $59 with mattress.

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Electron micrograph from "Interchemical Review"



Pores in slice of diatom skeleton are plainly visible (above) when magnified 20,000 times. Enlarged drawing at left shows jewel-box structure of whole diatom—one of 10,000 known shapes.

Old Skeletons Fill New Jobs

Fossilized shells of microscopic plants that lived 50,000 centuries ago work wonders for modern industry in making products you use every day.

By Andrew R. Boone

TINY water plants that lived and died five million years ago are one of the most useful materials of American industry.

Their skeletons, more beautifully intricate than snowflakes yet so small that a billion of them would barely fill a pint jar, do literally thousands of diverse jobs in modern industry. They make blotting paper more absorbent. They prevent afterglow in matches. They cut the cost of gasoline, deaden sound in dance halls, take the shine out of paint, put added sparkle in your beer. The list could easily go on to fill this page.

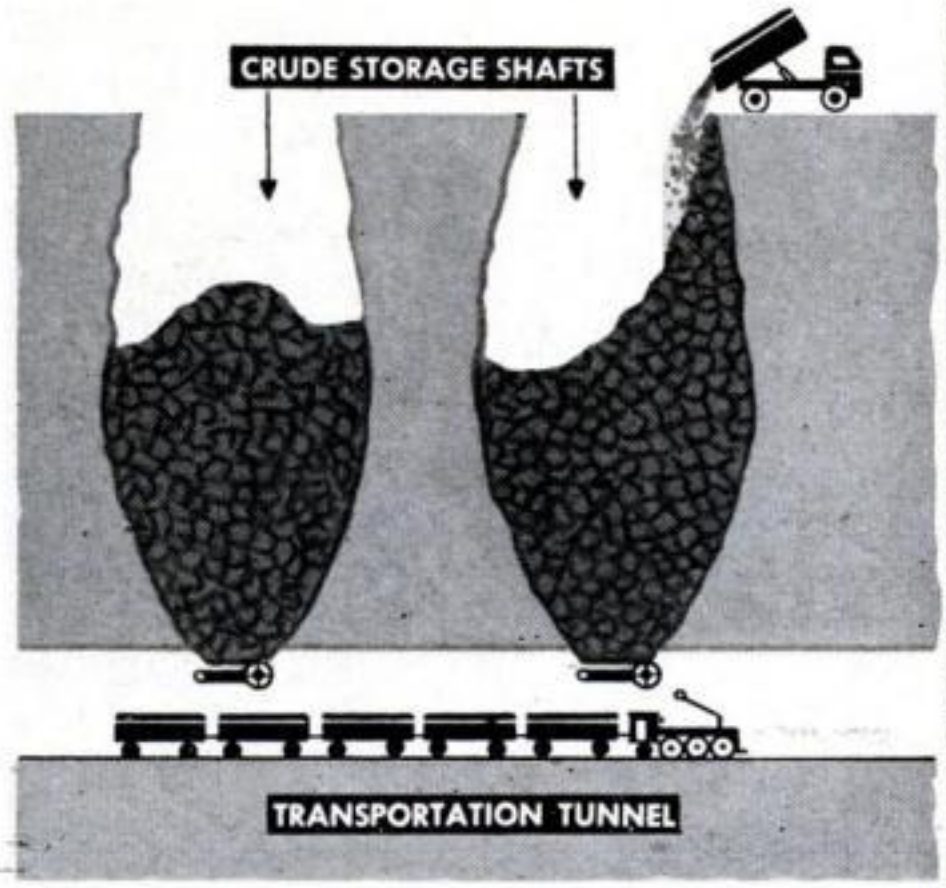
These wonder-working plants are called diatoms. They still grow abundantly in both salt and fresh water all over the world—wherever light and moisture are found with silica, a nonmetallic mineral from which they build their microscopic bones.

A kind of free-floating pond scum, but looking more like midget oysters than like any plant you'll find in your garden, the diatoms consist of two transparent shells folded over an oily cell. Scientists have classified and named more than 10,000 different shapes, from disks to needles. They multiply

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Five-yard bite of diatomite—fossilized diatom skeletons—is scooped from 4,000-acre deposit near Lompoc, Calif., by power shovel. Johns-Manville company operates this open-pit mine.



Trucks dump crude material into huge storage bins carved from the deposit. The shafts load small train in tunnel at same level as mill.



Electric train carries diatomite to crushing mills. From those it goes to furnaces and blowers to be dried and classified for packing.

so fast by division of their single cell that one diatom could, theoretically, produce a billion descendants in a month. Only lack of enough food keeps them from overrunning the earth.

In the prehistoric Miocene Age, diatoms flourished profusely in the ocean and lakes along what is now the U. S. west coast—possibly because of unusually large amounts of silica in the water from volcanic eruptions. Their shells, sinking to the bottom as the plants died and rotted, accumulated at the rate of half an inch a year for 50 centuries. Later these fossilized skeletons were thrust high and dry by some gigantic shift in the earth's crust. Today they form vast deposits of almost pure silica in the coastal hills.

From a single 4,000-acre deposit, 1,400 feet deep, the Johns-Manville company quarries 100,000 tons of chalky diatomaceous earth a year near Lompoc, Calif. Other large open-pit mines are worked by the Dicalite Co. near San Pedro and in Oregon. Smaller veins of diatomite, as it's called for short, have been tapped in Washington, Idaho, Florida, Vermont, Virginia, and Europe.

At Lompoc, electric shovels load five-yard mouthfuls of the fossilized diatoms

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into trucks that dump them into "glory holes" hewed out of the underlying diatomite. Steel cars are filled from the lower ends of these storage shafts and drawn through a tunnel to a nearby mill.

There the crude diatomite is broken down into chunks smaller than your fist by a hammer mill. Riding a breath of hot air, the chunks then are blown through huge pipes until they become flourlike dust.

Under a microscope, this dust turns out to be not solid particles, but a mass of thin-walled holes so closely spaced that a pound of the material has a total surface area of 20,000 to 100,000 square feet. It's 65 to 95 percent air, weighs only 7 to 13 pounds per cubic foot, and will absorb 200 to 300 percent of its weight in water or oil.

Three main grades of refined diatomite are used by industry—natural, calcined, and white.

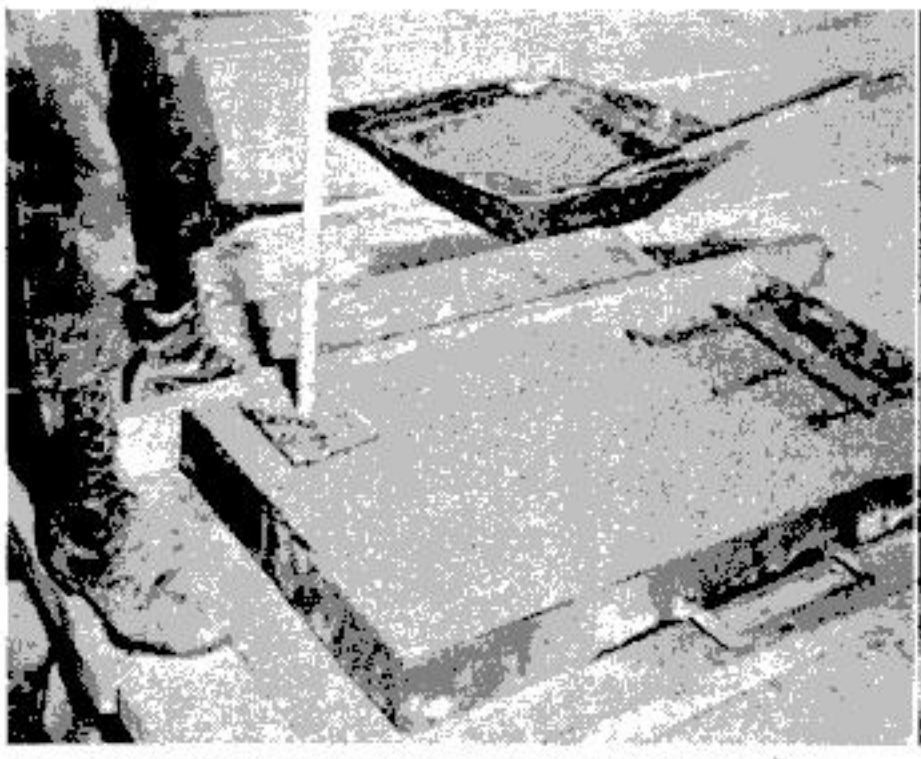
Naturals are processed simply by drying, milling gently to separate the individual diatoms without breaking their shells, and sorting them by air blasts into desired sizes. These are widely used as filtering agents. Mixed with cloudy liquid as it is pumped through a filter press, the diatom skeletons collect on cloth or wire screens along with suspended solids. The filter cake thus built up is kept porous because the particles separate the bits of solid and prevent them from forming a gummy layer that would block the flow. Products now filtered through diatomite run the alphabetical scale from acids and beer through lubricating and cutting oils to sugar, vitamins, and wax.

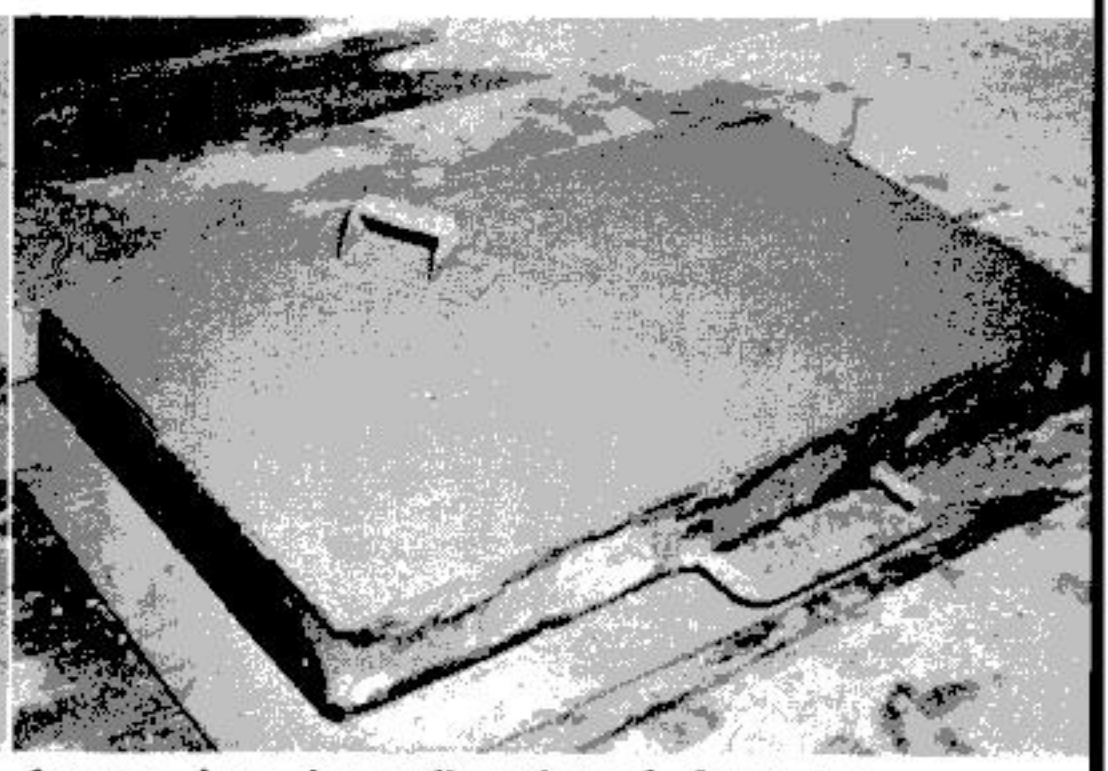
Calcined grades of diatomite undergo the same preliminary treatment as the naturals and then are baked at temperatures up to 2,900° F. This makes them practically insoluble even in strong acids and unaffected by extreme heat. Thousands of tons a year go into insulating material. They also serve as filtering agents for corrosive acids and as catalyst carriers in petroleum refining.

White grades of Celite ® and Dicalite ®, the trade names under which refined diatomite is sold by Johns-Manville and the Dicalite Co., are processed by calcinating in the presence of added fluxes. As inert, non-coloring mineral fillers, they add bulk to paper, without materially increasing its weight, and serve as a flatting agent in paint. Diatomite fillers also go into rubber, ceramics, plastics, asphalt, linoleum, and abrasive metal polishes and kitchen cleansers. In papermaking they not only improve the product, but keep the machinery free of pitch that would clog pipes and rollers.

Though new uses for diatoms are constantly being found, these minute plants are not new to science or industry. The Romans used diatomite in the construction of buildings, without knowing what it was. In 1702, in Holland, Anthony Van Leeuwenhoek first saw one while peering at a specimen of "clear" water through one of the 247 microscopes he built.

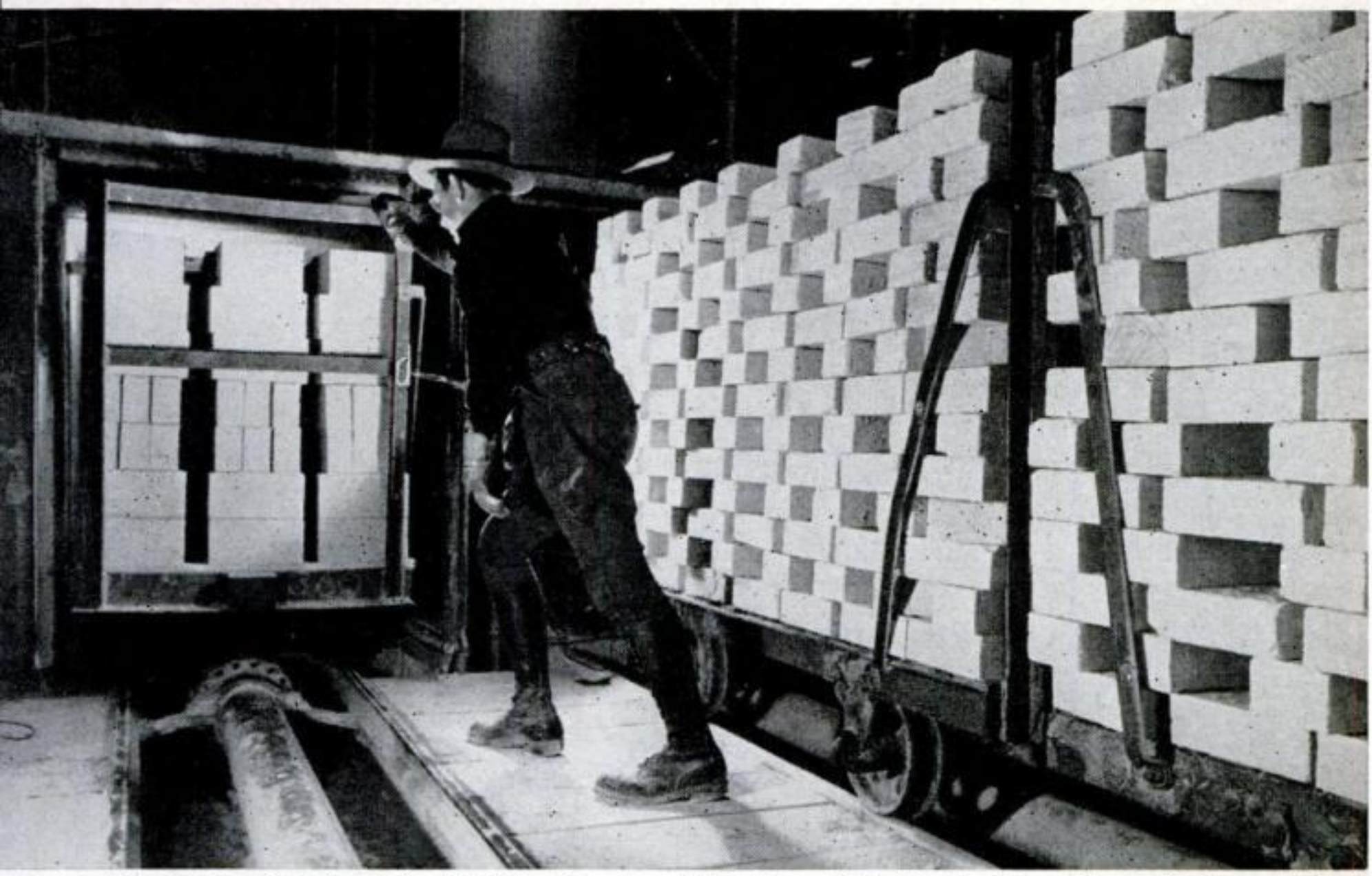
In modern industry, the diatom's career dates from 1866, when the Swedish chemist, Alfred Nobel, saturated diatomite with nitroglycerin to give the world its first stick of dynamite. Even distribution of the explosive through the fine filler made it safe to handle by insuring smooth, complete de-





As insulating material, calcined diatomite resists heat 10 to 12 times better than fire brick. Mixed wet with concrete and tamped into a form, as shown above, it makes a lightweight furnace door that will withstand direct temperatures as high as 1,800° F. It can also be used in powder form between brick walls, or as plaster over furnaces, boilers, and pipes.

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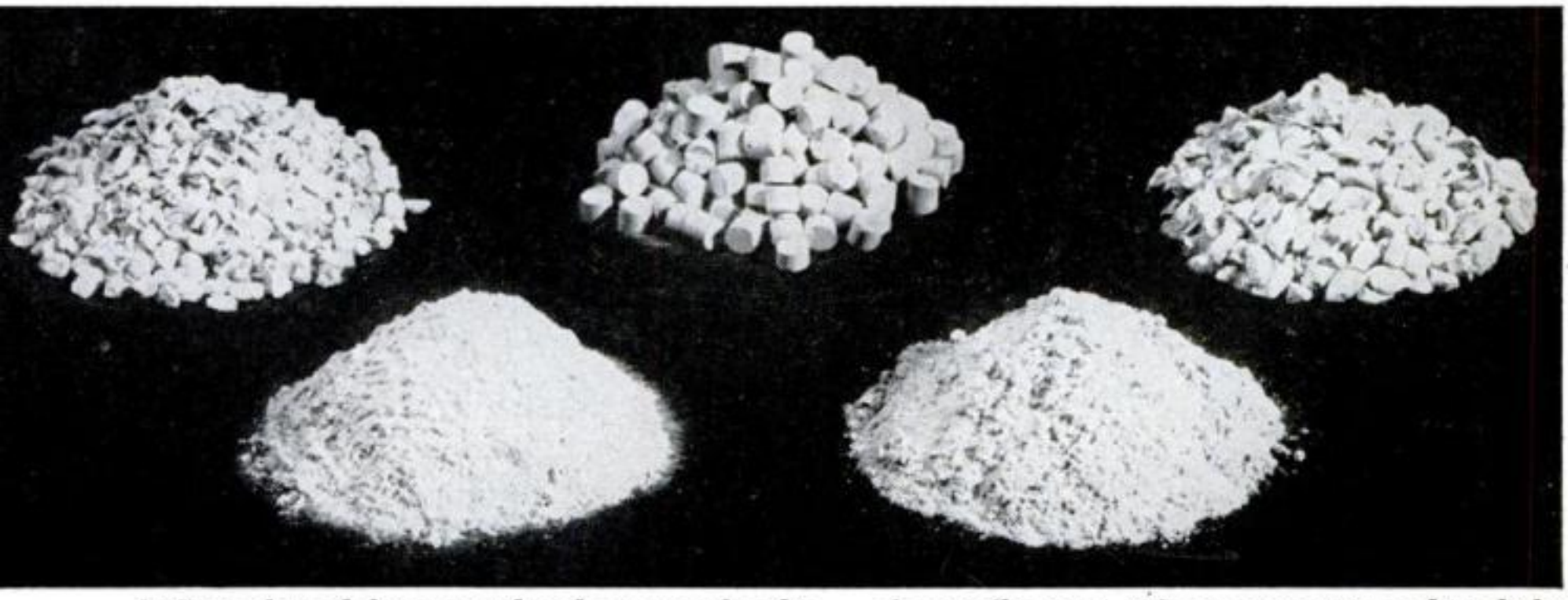


Insulating brick made of diatomite move into kiln for hardening and burning to increase their strength and resistance to heat. Porous structure of the material—millions of microscopic air cells per square inch—also makes it useful in floors and walls of buildings to deaden sound.

tonation. Today diatomite does much the same job every time you light a match.

In World War II, diatoms served on both sides. The Nazis used *kiesulguhe*, their name for diatomite, in synthetic production of gasoline. American infantrymen drank clean water from polluted streams by running it through diatomite in portable filters. The Navy used it to strain finely emulsified oil globules from steam-engine condensate for return to ships' boilers. A large tonnage went into lusterless paint for camouflage.

Now, like the men they fought beside in every theater of combat, the diatoms are finding more jobs than ever before in peacetime industry. END



Pellets shaped from powdered or granular diatomite serve as catalyst carriers in the refining of petroleum and production of acids. Though highly absorbent, the material—pure silica—is chemically inert. These properties and its light weight make it also a good carrier of liquid or gaseous insecticides and a useful fluffing agent for lightening and extending heavy dust poisons.

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Whole House Cast Like Toy

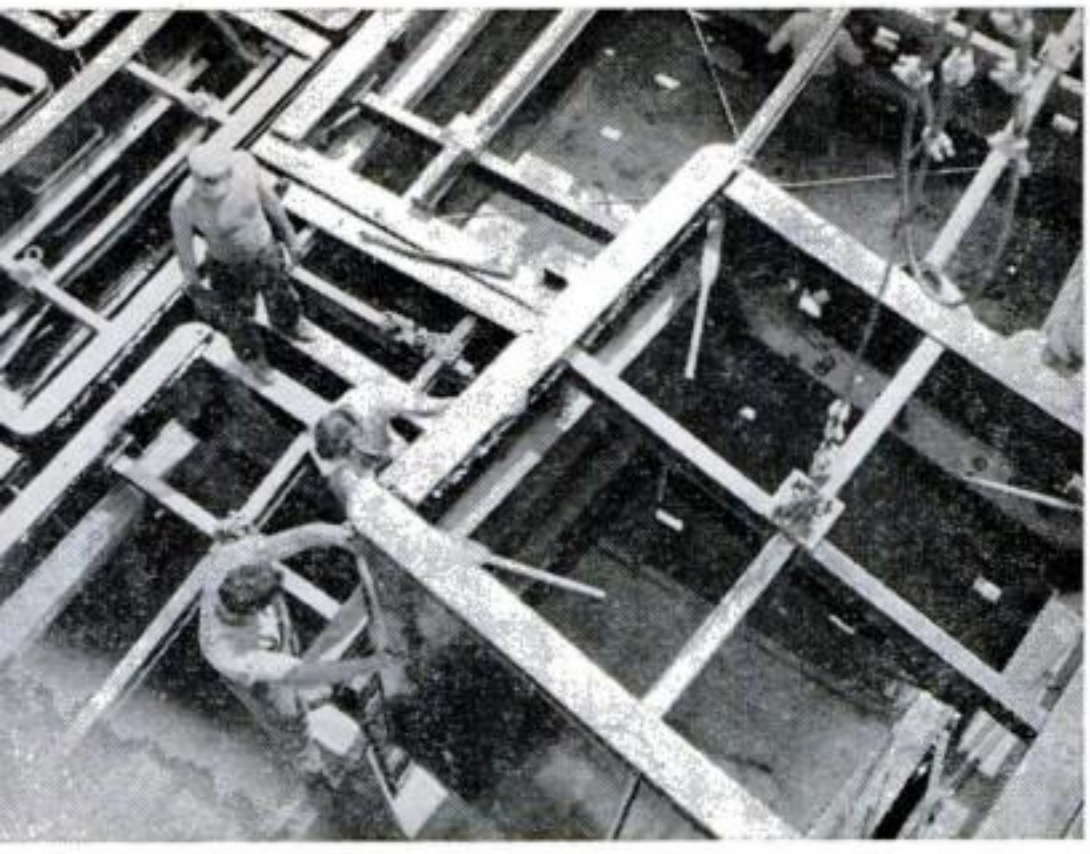
FULL-SIZE homes are being turned out of molds like toy soldiers in an experimental building project at Port Washington, Long Island. The houses are made almost completely in a single operation by pouring concrete into special forms that shape the entire unit—exterior and interior walls, rooms, hallways, doors, windows, and even moldings. No lumber is used below the attic beams and roof rafters.

The mold-casting method, developed by Patrick J. Callan, of Callan Builders, Inc., turns out a completed two-bedroom home in about six days. The cost is claimed to be 30 percent below that of comparable houses built by customary methods.

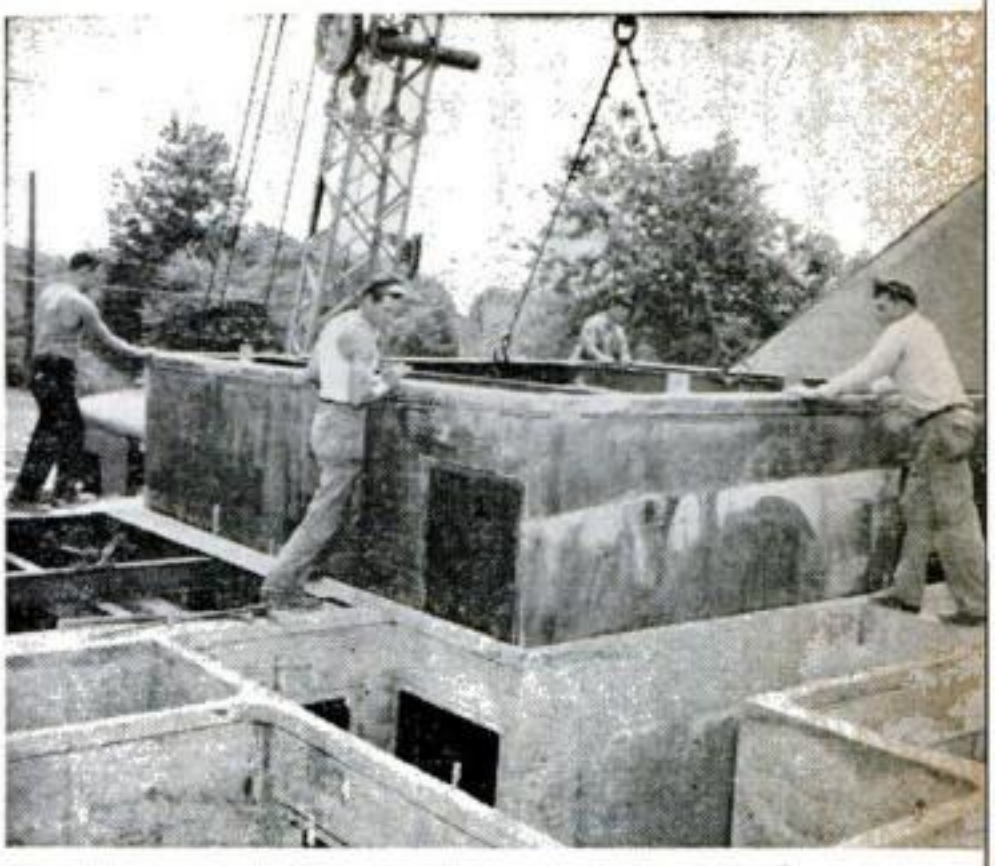


Cores that make individual rooms are carefully placed with crane. Multi-layer floor, containing pipes for radiant heating system, has already been poured. Special frames to form window and door openings are bolted to the cores—notice window form at left center. Huge matrices are bolted around the group of inside cores to form the outside walls of the house.

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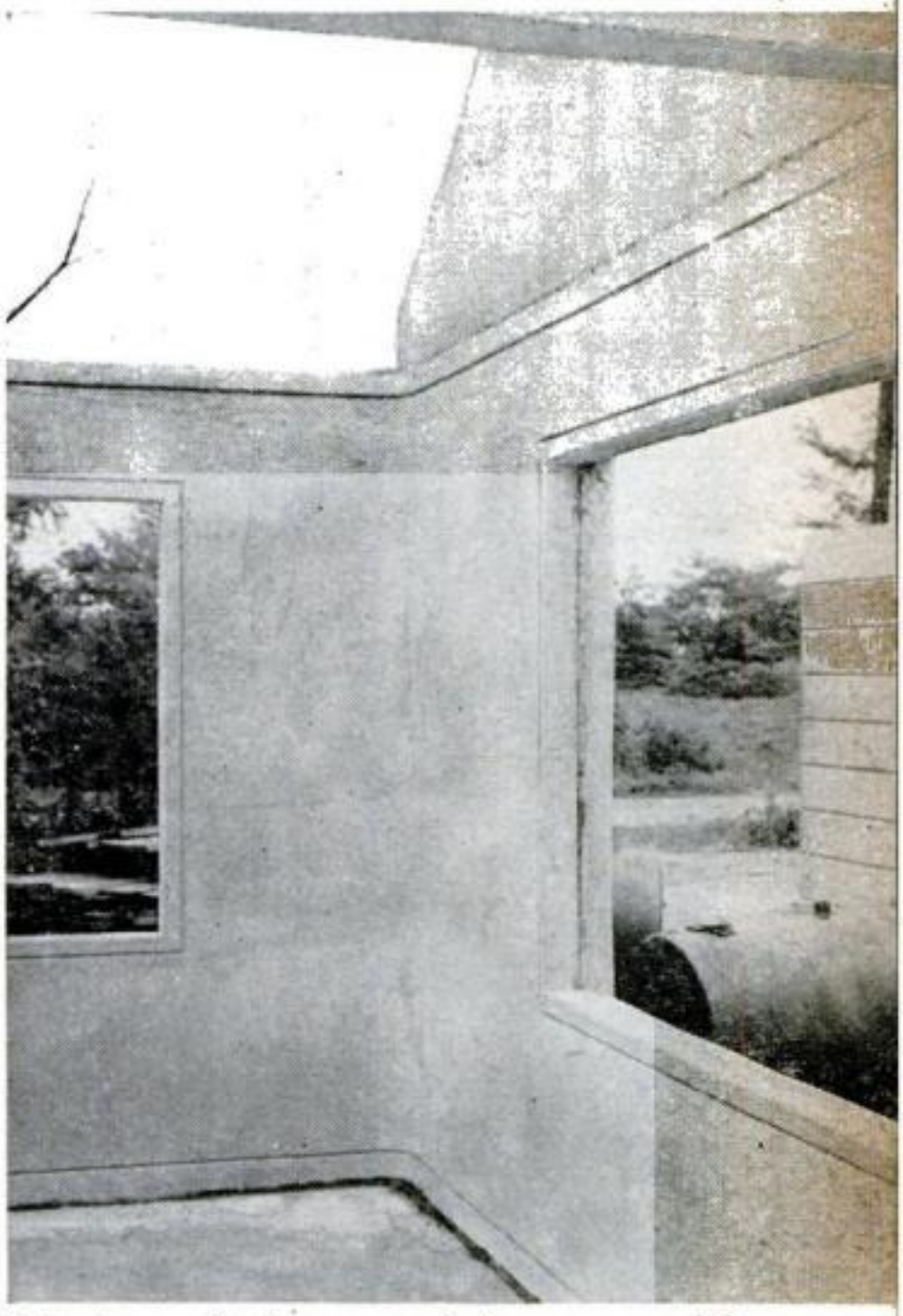
Core for one of interior sections is set down into the blueprintlike pattern made by the forms. The cores are made of heavy steel, polished smooth and clean, then sprayed with oil to prevent the concrete from sticking. Notice the bracing to insure against bulges in walls.



Five-ton core for living room is lifted out after the whole house has been poured in one operation. The walls made in this way consist of two layers of monolithic concrete reinforced with steel road mesh and separated by special insulation to resist moisture from condensation.



Workman removes the steel form that makes bathroom-window opening. Even the spaces for switch boxes and door hardware are cast with the house. Notice beveling on the exterior wall, designed to make the house look like a farm cottage surfaced with heavy clapboard.



Interior walls have rounded corners and beveling to look like moldings. After casting, walls are scoured with steel wool to give a finish smoother than plaster. Paint or wallpaper is applied directly on concrete. Forms, designed in four-inch modular units, permit layout variety.

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ENTIRE TUNNEL IS FILLED WITH WATER

90° MITER BEND

HYDROFOILS DEFLECT WATER AROUND RIGHT-ANGLE TURNS WITH MINIMUM TURBULENCE AND LOSS OF SPEED

DIFFUSER

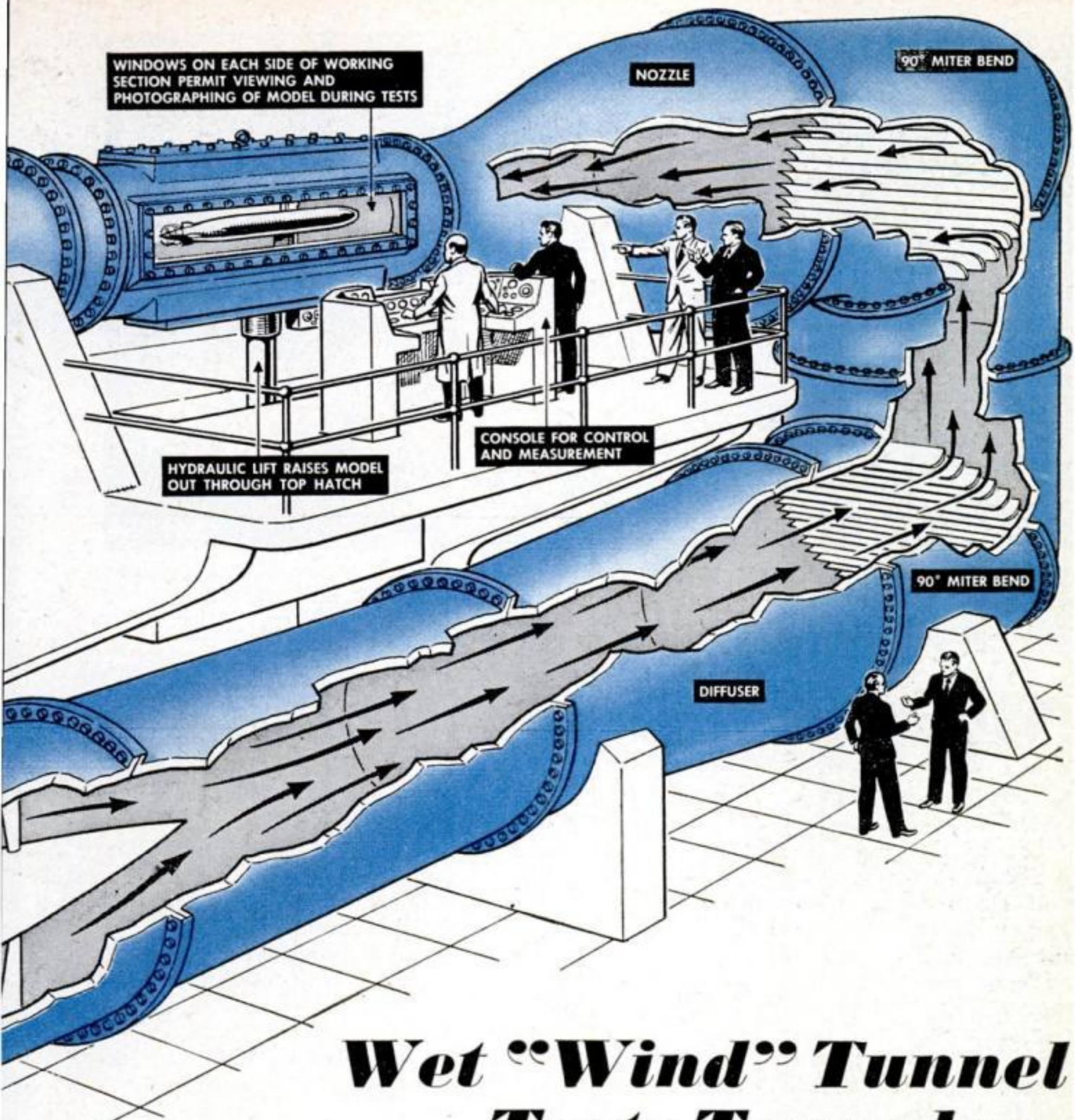
DIFFUSER

FOUR-BLADE, ADJUSTABLE-PITCH IMPELLER 95 INCHES IN DIAMETER

90° MITER BEND

SHAFT CONNECTED TO 1,750-HP. MOTOR TURNS IMPELLER AT 70 TO 175 R.P.M., MOVING WATER THROUGH WORKING SECTION AT 6 TO 60 FT. A SECOND

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Wet "Wind" Tunnel Tests Torpedoes

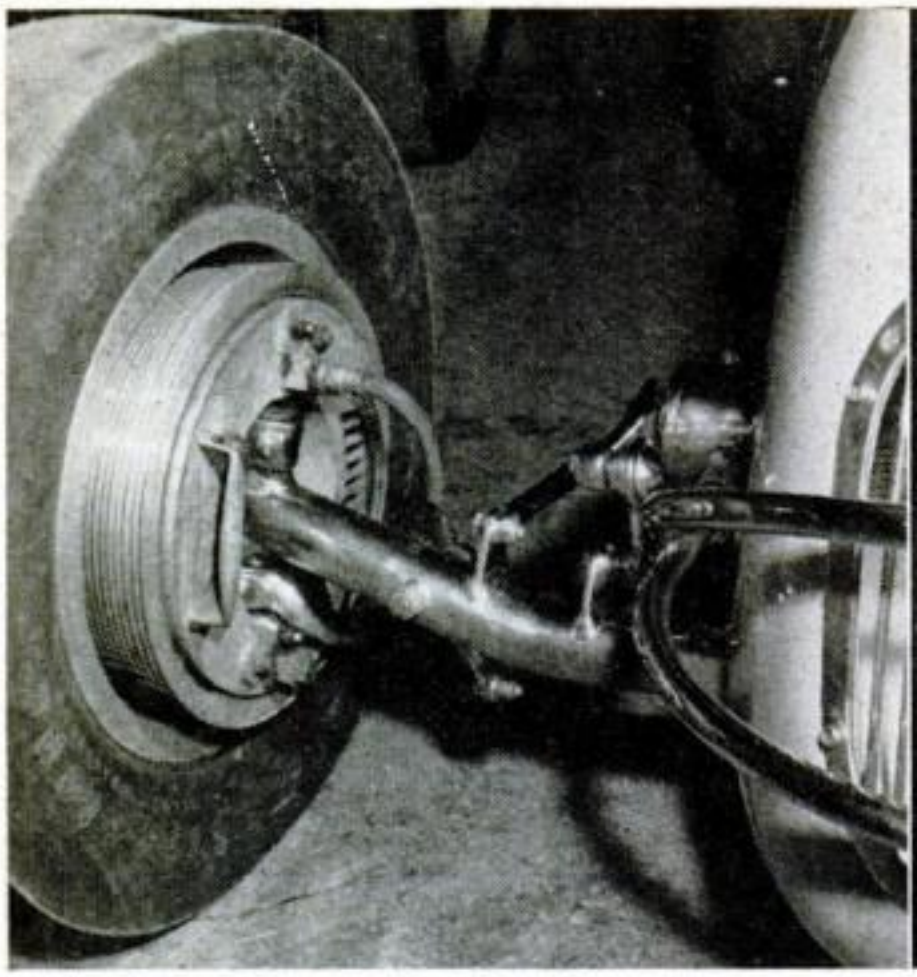
YOU'VE heard lots about how wind tunnels are used to test models of new airplanes. Now comes the water tunnel to do the same thing with underwater missiles.

The 600-ton water tunnel shown in this cutaway drawing will be the biggest ever built—97 ft. 7 in. long, 31 ft. 1 in. high. It will be completed next year at State College, Pa., by Pennsylvania State College and the U. S. Navy's Bureau of Ordnance.

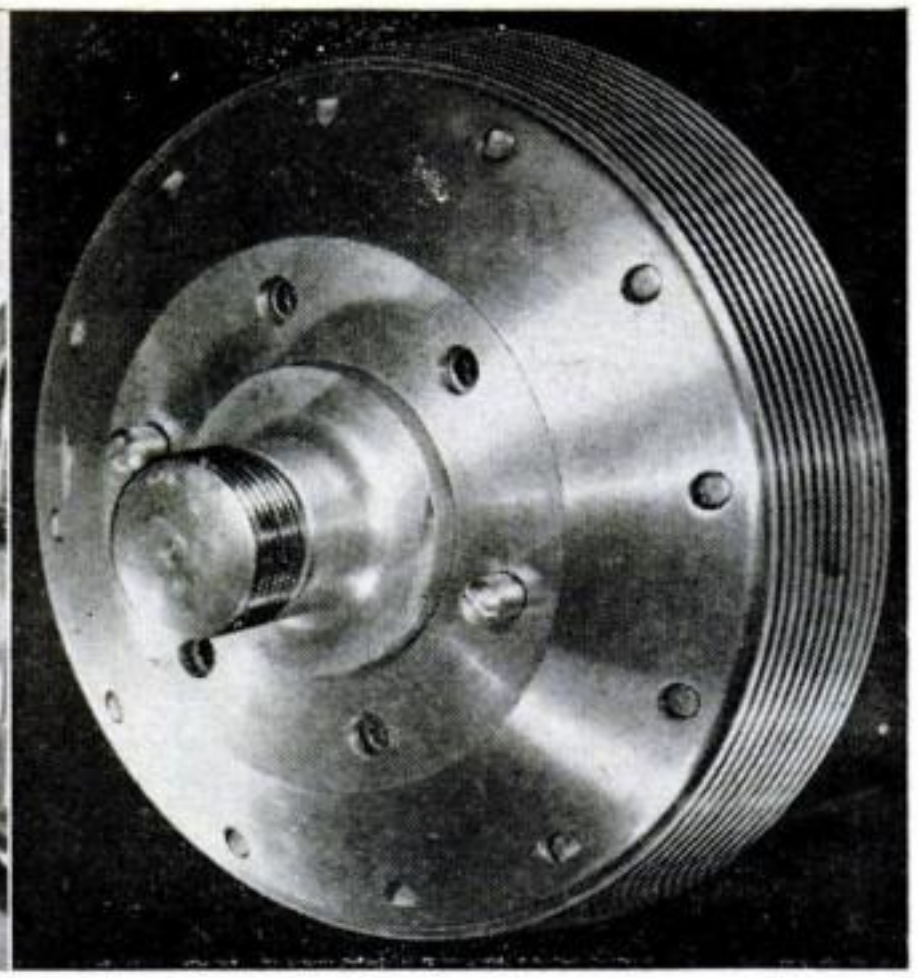
In its working section, 4 ft. in diameter and 14 ft. long, engineers will be able to watch, photograph, and measure the performance of test models as if they were traveling under water at speeds up to 41 m.p.h. At full blast, 100,000 gallons of water in the tunnel will make a complete circuit of the huge tube every 18 seconds.

With the tunnel's electric pump turned off, the models—up to 8 ft. long and 8 in. in diameter—also can spin their own motor-driven propellers in static water at pressures of 3 to 60 lb. per sq. in. and temperatures up to 120° F. Other controls will keep the water clear and regulate the amount of gas dissolved in it. END

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Installed on midget racer, finned brake drum extends into air stream for greater cooling effect. Customary air scoop in front and exit vents in back keep hydraulic brake shoes cool.



New brake drum, using aluminum alloy chemically bonded to cast iron, employs iron only as liner to grip brake shoe. Liner is much thinner than usual. Eleven fins help dissipate heat.

New Brake Sheds Heat

NINE chances out of ten, the runaway car, truck, or bus is the victim of overheated brakes. That's because brakes begin to lose their grip when they get hot. Now metallurgists have found a way to keep brakes from overheating. By bonding aluminum to cast iron in a chemical process developed during the war for use in air-cooled aircraft engines, they have produced a brake that gets just so warm and no warmer.

The trick in the new brake is in the aluminum. This metal has an extraordinarily high heat conductivity—it spews heat away from itself more than twice as fast as iron.

To speed up this dissipation of heat even more, the designers of the new brake, the Al-Fin division of the Fairchild Engine & Airplane Corp., have borrowed another page from the design of air-cooled aircraft engines. They have encircled the brake drum with fins. Increasing the surface over which heat is lost, these help dissipate the excess heat from friction in the brake drum in the same way that the fins belting the cylinders of aircraft engines help carry off the excess heat of combustion.

On the race track, where a midget racer was used as a guinea pig for the aluminum-iron brake drums, the ordinary brake builds up heat rapidly. After a few laps, the brakes, jammed on every time the driver hits a turn, heat to about 750° F.—and they don't lose that heat. The drums act as a reservoir or trap for the heat. The brakes of some racers have even become incandescent.

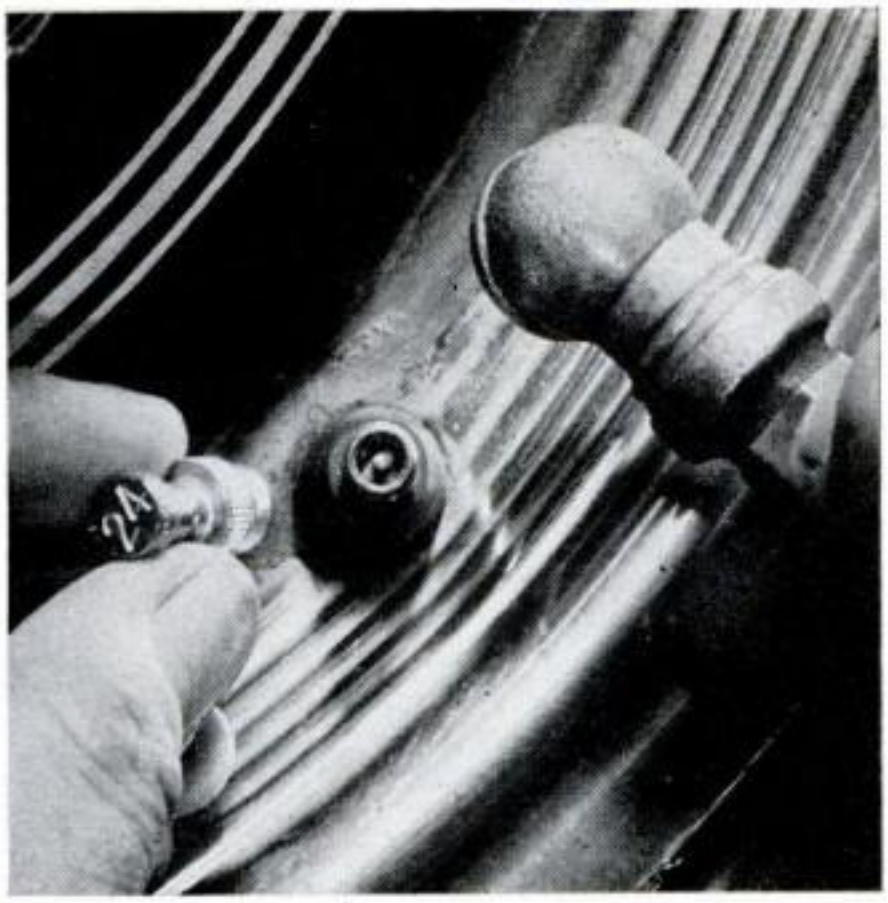
This, incidentally, slows down a race. A driver gets worried about his ability to cut his speed on the turns, and his accelerator foot gets light.

The Al-Fin ® brakes on the test racer were used in as many as 15 consecutive races without showing wear or needing adjustments. Ordinary iron brakes must be relined after a single 100-lap event. Even after eight or 10 hard laps, they begin to "fade"—lose their braking power. Adjustments must be made after every race, and the brakes frequenty show signs of scoring and discoloration.

The new brake is afflicted with none of these ills. It heats to around 500° F.—and stays there. That's within the permissive heat limit. The significance of this performance is even greater for commercial vehicles than for racing cars. For bus and truck operators, too, must combat "fading": on a long down-grade, brakes that begin losing their grip are no joke.

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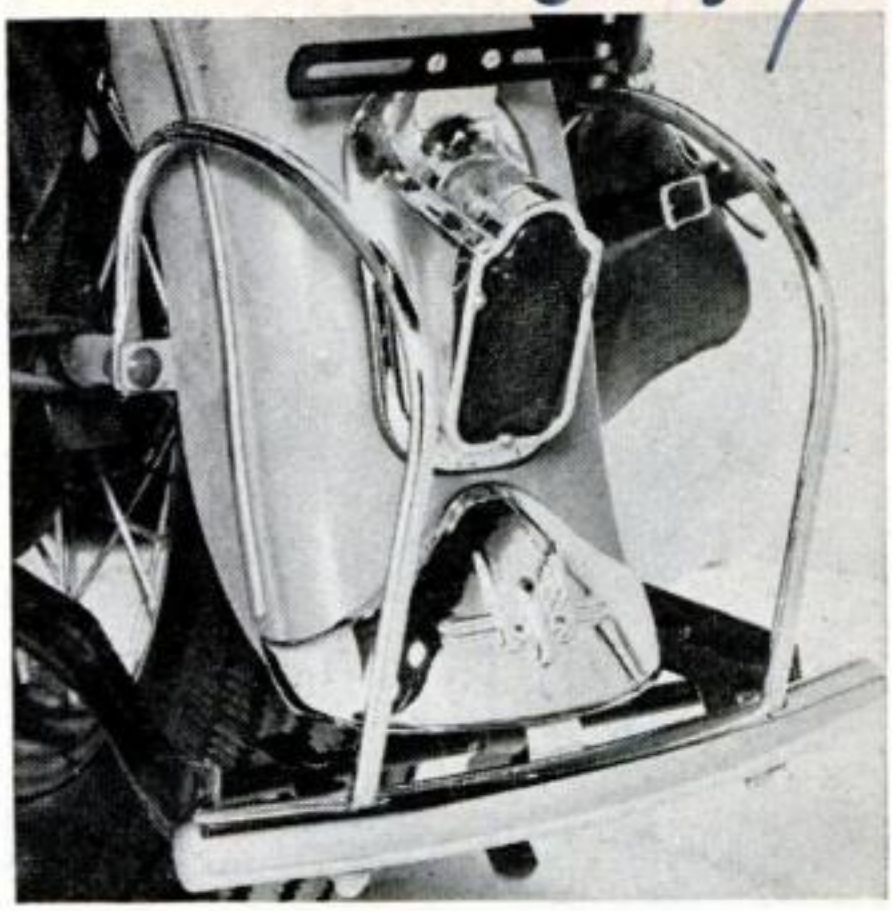
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Valve Cap Shows the Pressure

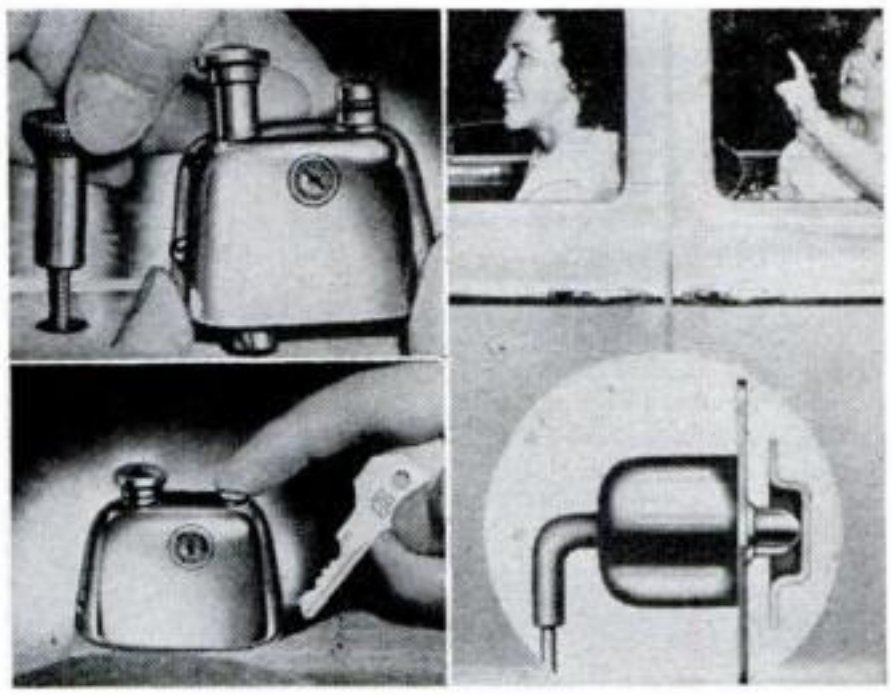
THESE valve caps tell service-station attendants exactly what air pressure you want. Especially good for low-pressure tires, the caps retail at a dime apiece. A. Schrader's Son, Brooklyn, N. Y., makes them with various pressure figures.

6077



Bumper Protects Motorcycle

COMBINING utility with good appearance, this new style Harley-Davidson rear bumper lines up with the rear stand of the motorcycle. Thus any impact from the rear is absorbed in part by the stand. The chrome bumper is available as an accessory.



New Locks Safeguard Children

KEEPING little ones from falling out a rear door has always concerned parents. Here are two locks to prevent this.

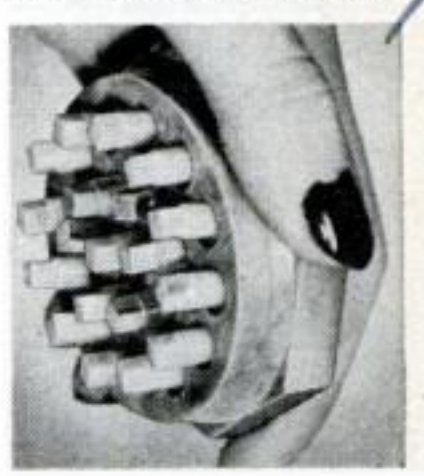
At left are two views of one made by Semco Research, Inc., Inglewood, Calif. The door-lock button now on your car is removed and the lock installed in its place. When the safety-button is depressed, the door must be opened with the ignition key.

Inset at right is a lock made by Accurate Tool and Engineering Co., San Diego, Calif. The lock is vacuum operated. The door can't be opened while the engine is running unless the driver presses a button.

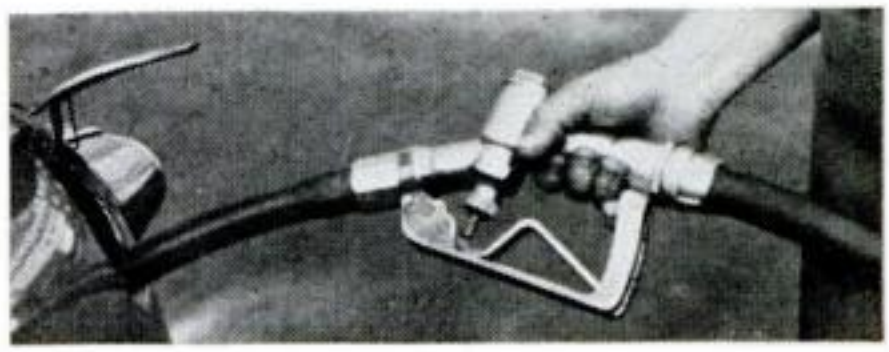
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6117

Removes Ice from Windshield



HERE'S a new device that's said to remove ice from windshields quickly and thoroughly. Made of plastic, it consists of a number of teeth set loosely in a base that fits the palm. Since the plastic is softer than glass, the windshield can't be scratched. Harshbarger Products Co., Detroit, makes it.



Gas Nozzle Made of Rubber

YOU'LL probably be seeing rubber nozzles like this one at gas stations before long. Just announced by The B. F. Goodrich Company, it eliminates any chance of damage to the car finish or inlet pipe. It also safeguards against danger from static electricity.

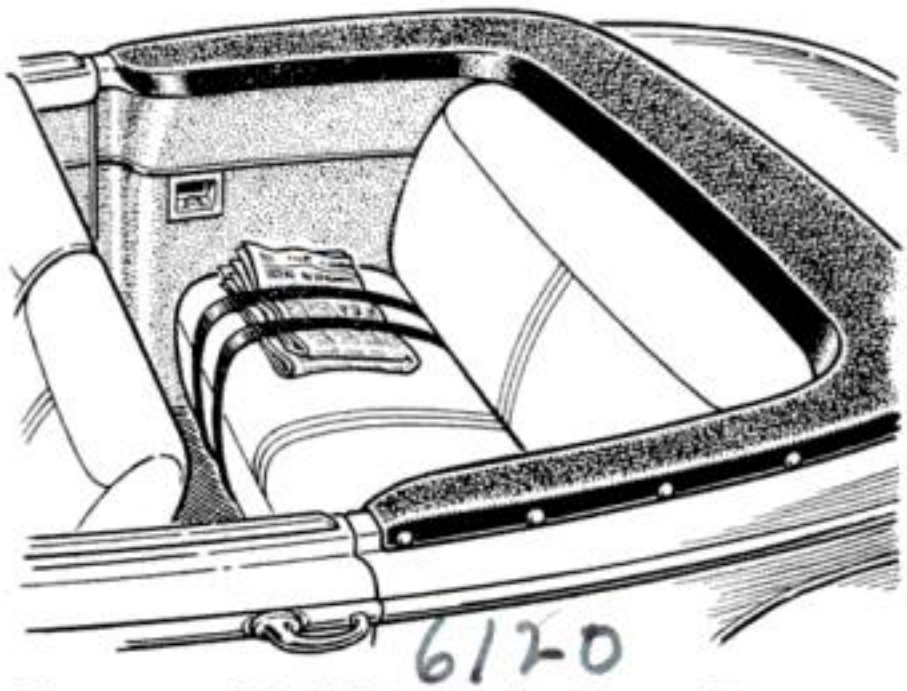
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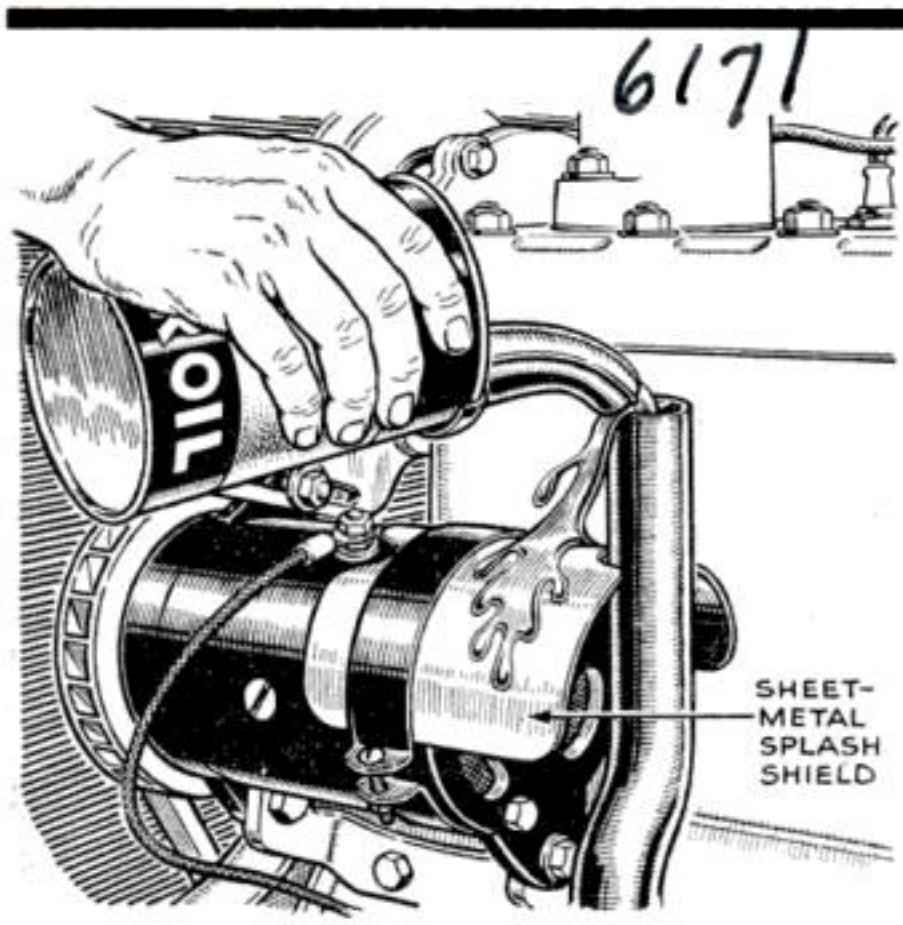
Hints from the Model Garage



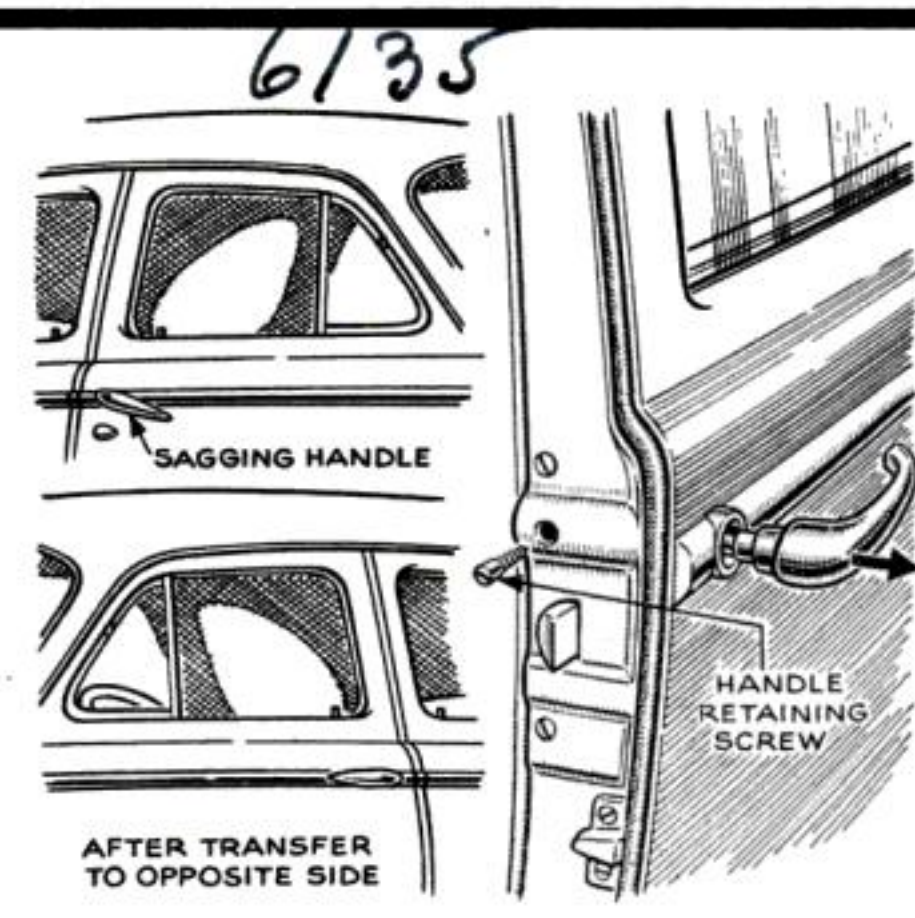
Prevent Overinflation. The new low-pressure tires are sometimes overinflated through carelessness. As a reminder to service-station attendants, paint the correct pressure on the rim beside each valve stem with white enamel, or apply waterproof adhesive tape with the figure inked on. You can also buy markers for your caps. See page 169.



Straps Hold Back-Seat Items. If you own a convertible, here's a hint that may be useful. David A. Wallace, of Ada, Mich., suggests that one or more elastic straps placed around the rear cushion will keep papers or loose clothing from blowing out while the top is down. The straps won't interfere with passengers.

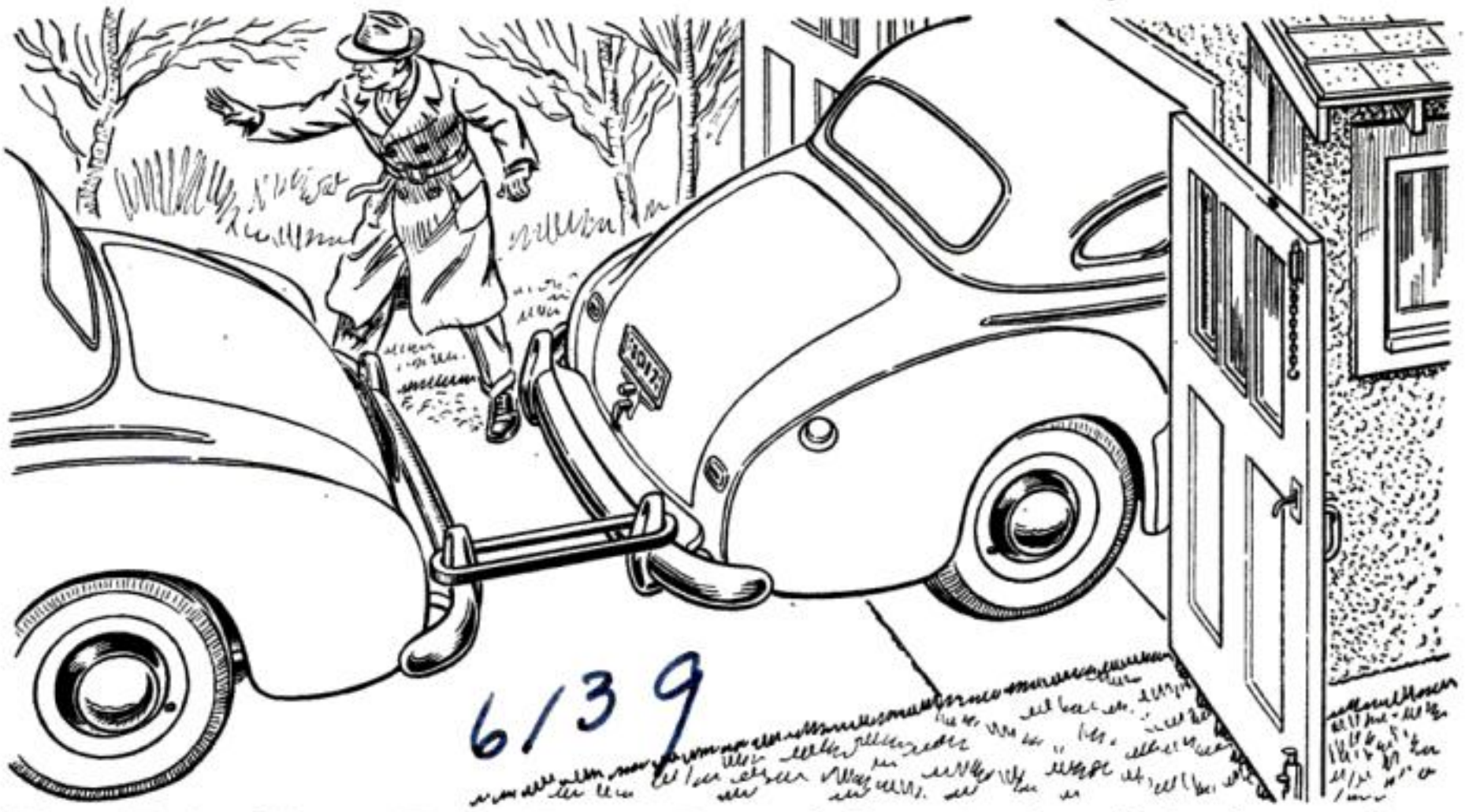


Shield Protects Generator. While filling up with oil, you may have noticed that the attendant sometimes allows a little to slop over the filler tube. Ray Wolfram, of Chicago, writes that he finally traced a mysterious generator trouble to such carelessness. Spilled over the generator, the oil had fouled the brushes. To prevent this from happening again, he installed a metal shield as shown.



Reverse Sagging Handles. On some cars the door handles eventually wear enough so that they sag below the chrome strip they were designed to parallel. Don E. Braman, of Little Rock, Ark., found a simple solution for this on his 1941 Chevrolet. Removing the handles, he transferred each to the door on the opposite side. There, since the worn part was up, the handle didn't sag. Three minutes did the job.

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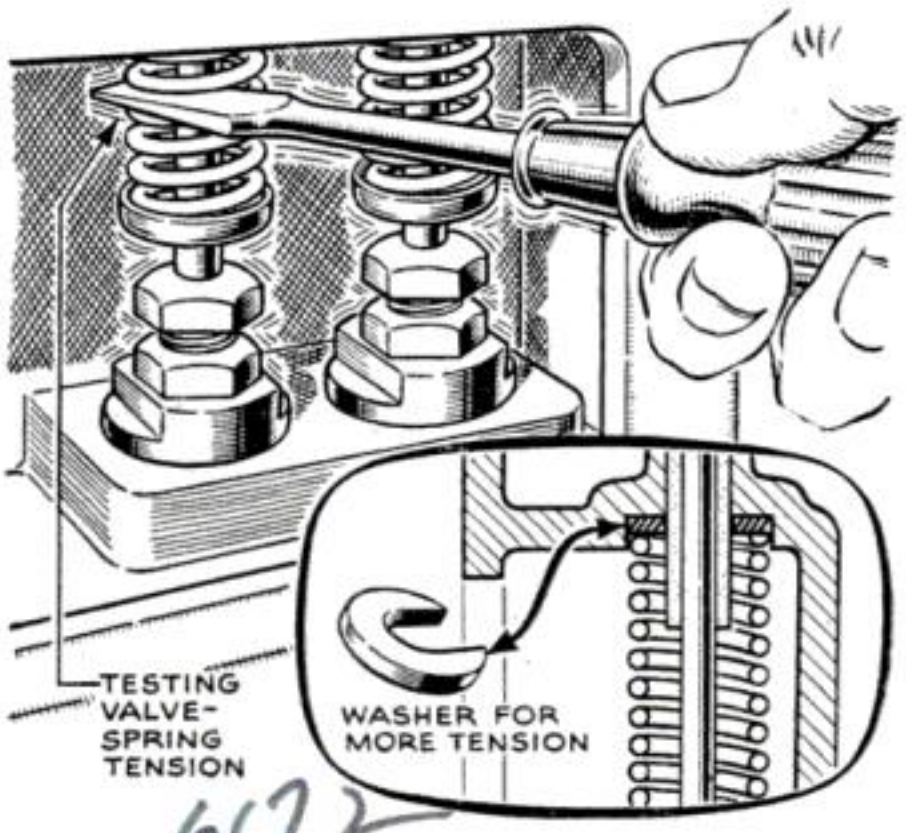


6139

Fan Belt Gives Tow. Forrest F. Starr, of Columbus, Ohio, makes a suggestion that may help you out of a tough spot.

"My neighbor's car was stuck in soft ground," he writes. "Having no suitable rope or chain, I used an old fan belt. It worked surprisingly well, for the stretch in the belt got the car started to rocking without any sharp jerks. I've carried the belt ever since for just such emergencies."

As seen above, the belt is especially good when you can't push the stalled car.



6122

Washer Quiets Knock. A knock may occur at idling speed if the camshaft gear is worn and one or more valve springs do not have sufficient tension. W. M. Dierks, of Chicago, says such knocking usually can be quieted in the following way. With the engine idling, insert a screwdriver into each spring. When the knock stops, you've found the faulty one. Force a horseshoe washer 1/16" thick under the seat.



6114

Plastic Keeps Door Clean. Most everyone these days installs seat covers in a new car, but few give any thought to the door areas, where hands frequently soil the covering material. Frank J. Montemuro, of Philadelphia, is one person who does. Cutting a sheet of clear plastic to fit, he installed it as a shield around the door and window handles on each door. The plastic is easily wiped clean.

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6177

Fenders Lift Off for Engine Work

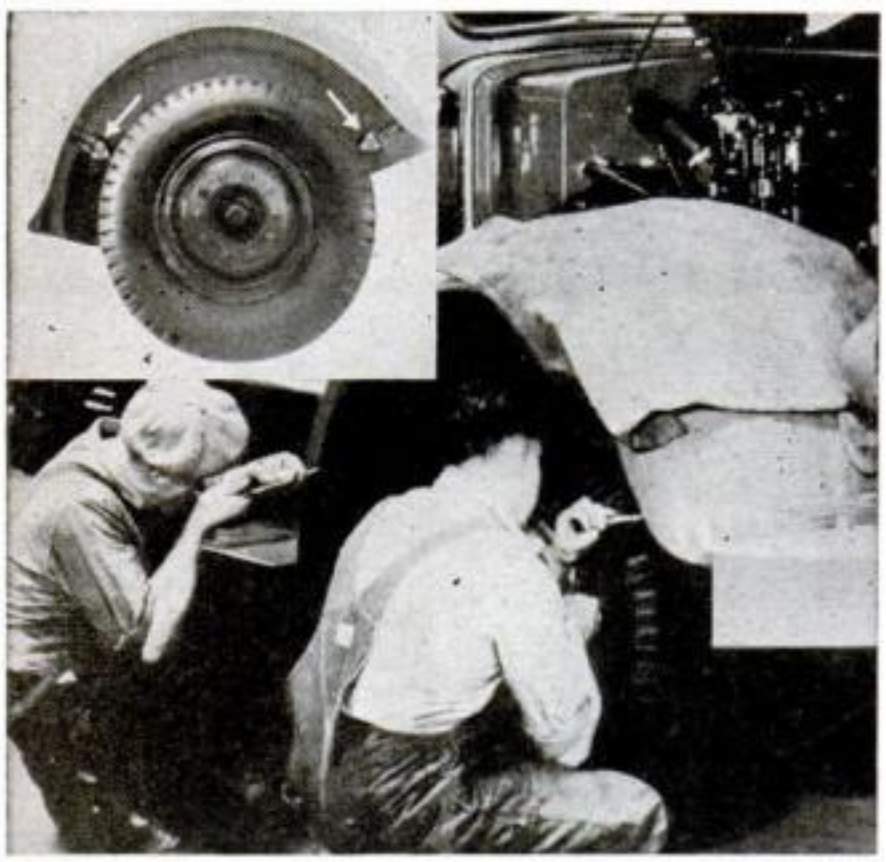
ENGINE repairs are a cinch on the new extra-heavy-duty truck models just announced by Diamond T. Now you have to be just a mechanic—not an acrobat too.

The engine's still hidden deep between two high-riding fenders, as it is in many cars. But there's a big difference. The fenders are quickly and easily removable when the engine needs attention. Eventually, all Diamond T trucks will have this feature.

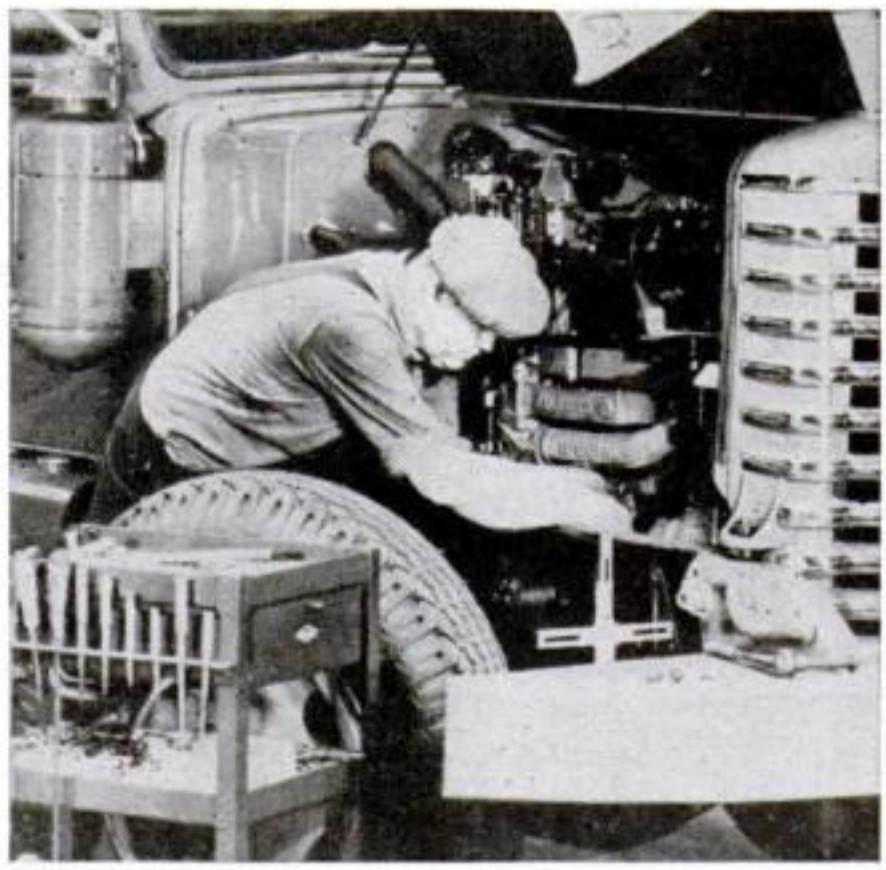
It's expected that every repair job below the cylinder-head level will be speeded up considerably. Not only can the mechanic work more comfortably; he can use power tools that previously were out of the question because of the cramped space.



Get it out of the way! Fenders are detachable on extra-heavy-duty trucks made by Diamond T.



Five minutes do the job. Working together, two men quickly remove the bolts (arrows) at each end of shield. These hold entire assembly.

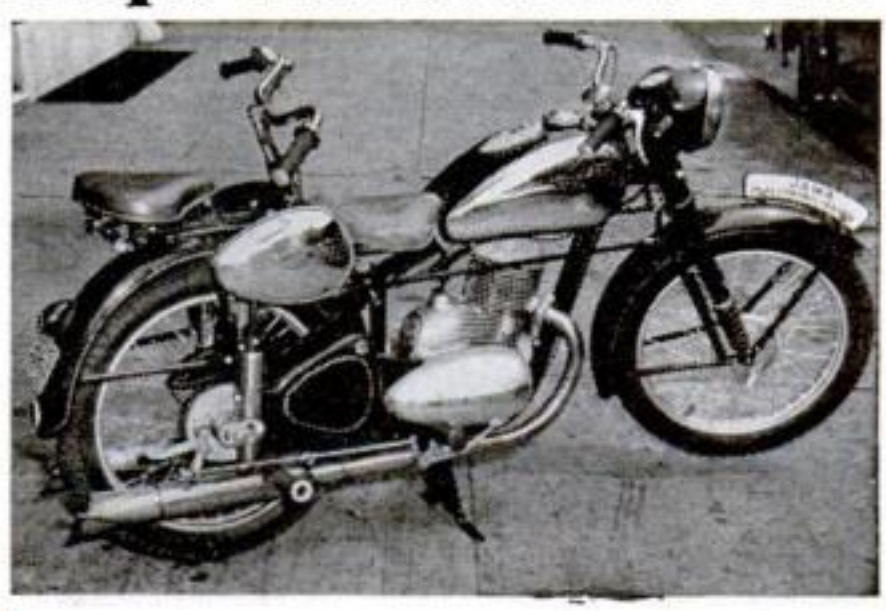


Now you can get at the engine. There's no need to stand on your head. The fender's gone. Note how readily mechanic can reach his tools.

Dual-Control Motorcycle Helps You Learn to Ride

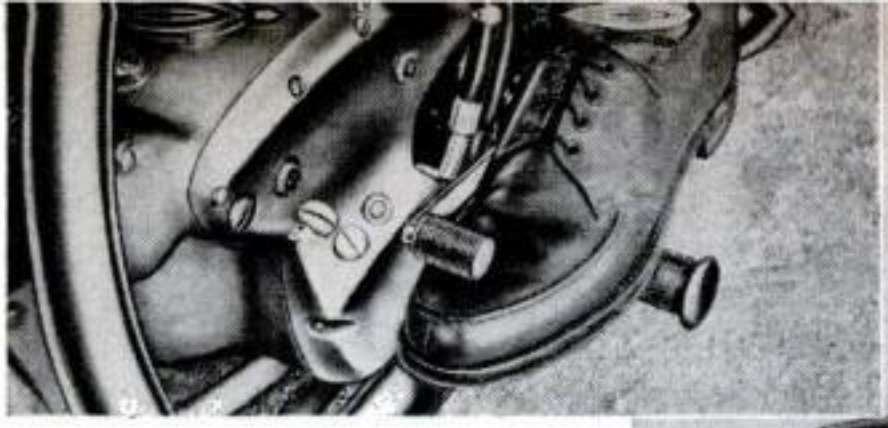
HERE's a way you can learn to ride a motorcycle with ease. While the student rides in front, an instructor sits behind.

Manufactured in Czechoslovakia, the trainer is distributed in the United States by Industrial Operations, Inc., of New York. It was developed from a standard 250-cc. Jawa (PS, Aug. '47, p. 140). The handlebars turn in unison, and either rider can operate the clutch and brake. There's only one gear lever, but it's within reach of the instructor as well as the student.



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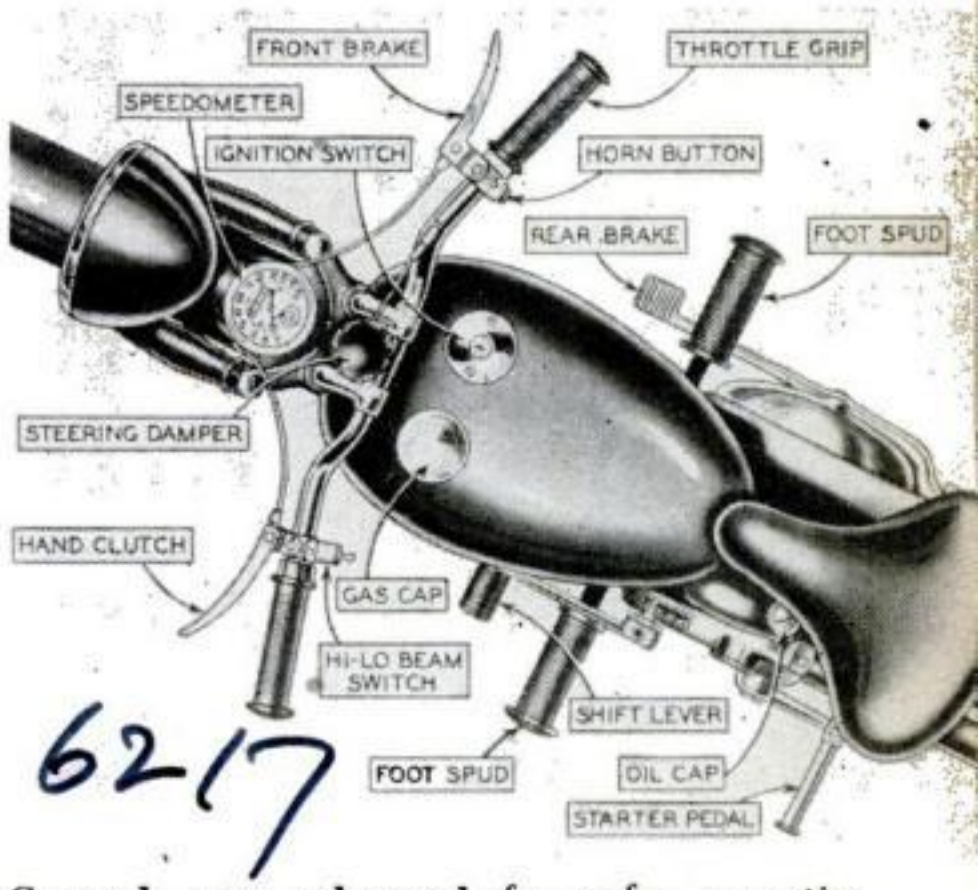
Foot shift, above, is found on both of the new Indians. You press up to shift up, and down to shift down. At right is the Gold Arrow, deluxe one-cylinder model. Note the new hydraulic fork. Top right you see cast aluminum cylinder head of the overhead-valve engine. Short push rods activate rockers in finned, ear-like housings.

Overhead Valves Power Two New Indians

IF ALL insignia were removed, you'd have trouble identifying the new lightweight Indians. The Indian Motocycle Company has never before made anything like them.

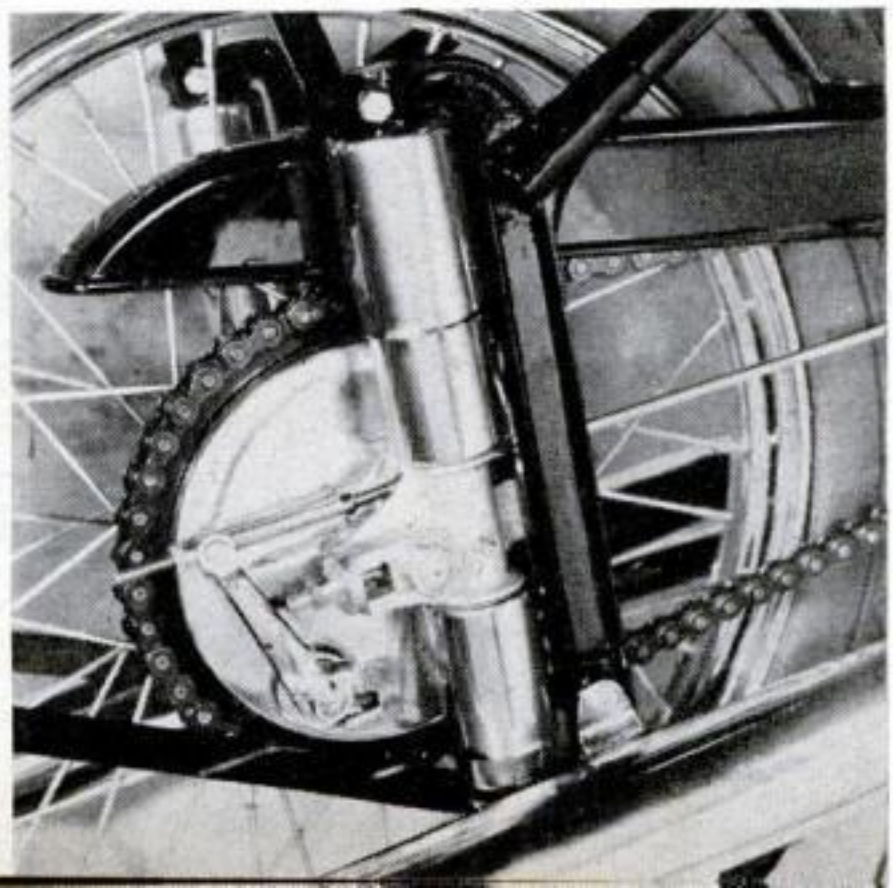
Both of the new series are powered by 7-to-1 overhead-valve engines. You shift by foot, operate the clutch by hand. You have a three-speed transmission with overdrive. Instead of exposed springs, you find a telescopic front fork. The one-cylinder Arrow weighs 240 lb., the twin Scout 275.

Displacement of the single is 13.3 cu. in., of the twin just twice as much since the bore is 2.375″ and stroke 3″ in each. These overhead-valve engines were designed especially for the new Indians. Features include bronze valve guides, valve seats, and spark-plug inserts in an aluminum head. The Arrow cruises at 60; the twin has a top speed somewhere in the 90's.

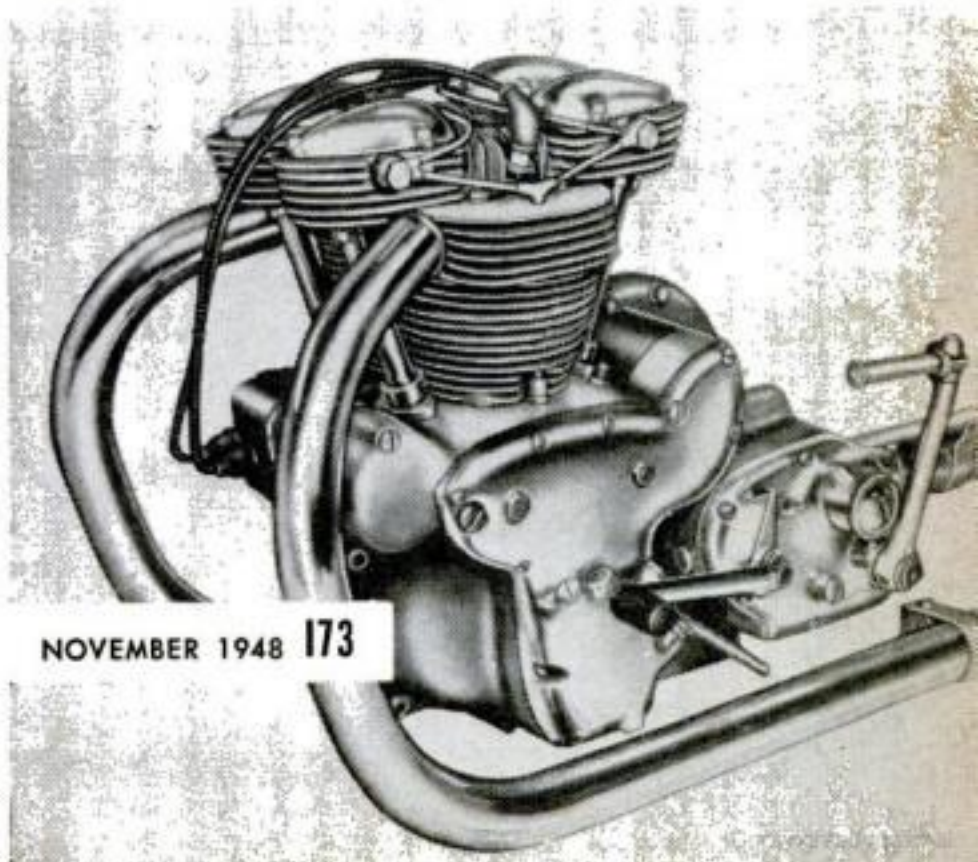


Controls are relocated for safer operation. Once under way, you can keep your feet on the spuds and your hands on the handle bars.

Coiled spring shock absorber of the plunger type carries the rear wheel, taking bumps out of the ride and giving better braking.



Side by side vertical twin engine is used in new Indian Scout. Both of the new engines have magneto ignition with automatic spark advance.



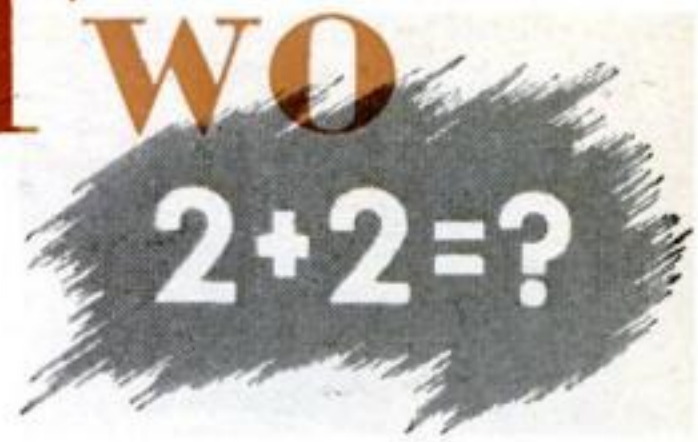
Gus Adds

Palmer filled the two-quart measure full of water and dumped it into the gallon container.

RAY QUIGLEY

6072 5391

Two and Two



But it doesn't always come out four, as a new customer proves in the case of Silas Barnstable and the missing antifreeze.

By Martin Bunn

LIKE most young auto mechanics who are worth what they get out of their pay envelopes, Stan Hicks loves to figure out new ways of doing things. Sometimes his ideas work out swell. Sometimes they don't.

Stan noted the time on the clock in the Model Garage and had to admit that this was one that hadn't worked out. He had masterminded a new method of truing a brake drum. It had looked good, but the work had taken him twice as long as it should have. He confessed as much to Gus Wilson.

The older man smiled. "We'll charge the customer for the time the job should have taken you," Gus said, "and charge the rest of it to experience."

Stan didn't say anything—just looked back toward the brake-drum lathe.

"Look here, kid," Gus went on, "I don't want to cramp your style, but you'll duck a lot of headaches if you'll remember that most shop operations have been done so many times that there's darned little chance of improving them. Two and two always add up to four. You can't get away from that fact."

"The dickens you can't," snapped a positive voice behind them. "A lot of people have gotten away from that so-called fact. Einstein has. And so have I."

Gus and Stan turned to stare at the owner of the voice. He was a tall, lean young man whose old-fashioned spectacles gave him a professorial look. The stranger grinned at them—a wide and entirely likeable grin.

"Excuse my horning in," he said, "but whenever I hear someone voice a fallacy, I have to up and speak my piece. I admit it's a bad habit and it puts me in wrong with people who aren't used to me. My name's John Palmer. I'm the new high-school chemistry teacher. I'm looking for Gus Wilson."

Gus laughed. "No need to look farther."

Palmer looked him over frankly. "They tell me you're a champ mechanic. I've brought my car around to you. There's something wrong with it that you can't fix."

"If you're so sure of that," Gus asked, "why bring it to me?"

"Want to show a friend of mine that he's wrong," Palmer told him. "I'll get the car." He stepped out of the shop and moments later drove a well-kept coupe into the garage. "Listen to that engine," he said.

Gus listened for half a minute. "Smooth as cream," was his verdict.

"Right," Palmer agreed. He took his foot off the accelerator. "Listen again."

"Idles perfectly," Gus said.

"Right again," said Palmer. "But how about this?" He pressed his foot sharply down on the gas. For a few seconds the engine galloped and ran roughly. Then it smoothed out again.

Gus nodded. "Not so good when you tramp the accelerator open from the idling position. That could be caused by . . ."

"I know," Palmer interrupted. "It could be caused by clogged carburetor jets—but it isn't. The fellow who came up with that diagnosis cleaned the jets."

"May be burned-out distributor points," Gus said.

"Could be," Palmer said, "except another mechanic made that guess a week ago and put in new points."

"Improper valve-tappet adjustment—" Gus began.

"Could make an engine act like that," Palmer finished. "True, but the valve-tappet clearances have been checked and rechecked. They're okay."

"How about a bad condenser?" Gus asked.

"That also could be," Palmer answered, "but the man who swore the condenser was

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The chemistry teacher grinned at Gus. "Bet you didn't find anything mechanically wrong with my car."



no good put in a new one. Didn't do a bit of good."

"Well . . ." Gus started to say.

"Wait a minute," said Palmer. "I'll tell you what's wrong. It's the gas we get these days. I've specialized in the chemistry of petroleum, and I tell you that today's gasoline—you know anything about chemistry?"

"Nope," Gus said, "and I don't know much about mathematics either, but I still believe two and two always make four. If you want to leave your car here a few hours, I'll find out what's wrong with it and fix it—or I won't charge a cent."

"Fair enough," Palmer grinned. "But you're wasting your time. I know it's the gasoline. Suppose I come back at four o'clock?"

"Okay," Gus agreed.

KNOW-IT-ALL kind of a guy," Joe Clark observed, coming up to Gus after Palmer had left. "I don't get that business about two and two not making four." And if anybody knows about two and two adding up to four, it's Joe. Ever since he and Gus have been partners, Joe has taken care of the front office and the bookkeeping.

"Oh, he's probably a good egg at heart, though," Gus said. "Maybe I can show him he doesn't know as much as he thinks he does—about gasoline and cars, anyway. I've got a pretty good idea what's wrong with his engine. A little checking—now look what the wind blew in."

Joe turned to see what the wind had blown in. It was old Silas Barnstable, our town's leading tightwad. Silas announced that he wanted some antifreeze.

"You better go see one of those cheap skates you do most of your business with," Gus said flatly. "Try the one who sold you that stuff that clogged your radiator last year." Gus beckoned to Stan to come along and walked back to the brake-drum lathe.

"Wasn't the antifreeze that clogged my radiator," Silas yelled after him. "And you can't blame a man for buyin' cut-rate when he gets a chance. Dollars don't grow on trees, you know."

"Okay, okay, Silas," Joe said quietly. A customer's a customer to Joe, even if he's twice as ornery as old Silas. If that's possible.

"I want a good alcohol antifreeze and I'm willin' to pay for it," Silas said, still talking loud. "If you don't stick me as if I was buyin' champagne," he added.

"We're handling a standard alcohol antifreeze," Joe told him. "Mixed with water, half and half, it'll protect your engine down to twenty below zero. I'd say your radiator'll hold . . ."

"Four and a half gallons. I measured it," Silas said.

"That's eighteen quarts," Joe calculated. "So you'll need nine quarts of antifreeze."

"How much a quart?" Silas demanded.

Joe told him.

"That's outrageous," Silas stormed. "I ain't made out of money and that stuff ain't made of gold." Then, as Joe didn't answer: "All right. But it's profiteering."

Joe laughed. "Drive your car in and Greg'll put it in the radiator for you."

"No he won't," Silas snapped. "It ain't cold enough yet and maybe it won't be cold enough for a couple more weeks. I ain't gonna waste good money boilin' away antifreeze in weather when it ain't needed. That's why I brought this can."

"All right, all right," Joe said. "So take it home with you. When you're ready to use it, just add an equal amount of water."

"That won't do neither," Silas objected. "I got to use mighty hard well water out where I been livin' since I moved out of that outrageous-priced Hillside apartment. That's what clogged up my radiator—the hard water, not the antifreeze. I want you to mix my antifreeze with city water."

"Okay," Joe agreed patiently. He called Greg Jones, the grease monkey. "Pour nine quarts of antifreeze into this can," Joe instructed, "and add nine quarts of water to it. Be careful, now. Nine quarts of antifreeze and exactly nine quarts of water. And screw the cap on good and tight so the antifreeze won't evaporate."

"Yes, sir," Greg said, "nine quarts of anti-

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freeze and exactly nine quarts of water."

"That's right," Joe told him. "Hop to it."

Greg did, and as Silas stalked out with his can, Gus looked up from his job.

"I wonder," he mused aloud, "whether he'll be back today or tomorrow."

"What d'you mean?" queried Joe.

"I just remembered that our friend Palmer may be right—sometimes," Gus replied with a mysterious grin. "You're good at math. When does two and two not make four?"

JOHN PALMER and four o'clock arrived at the Model Garage exactly together.

"Bet you didn't find anything mechanically wrong with my car," he grinned. "I think you'll wind up agreeing with me that it's the gas."

"Your engine's rough acceleration," Gus smiled, "was caused by a weak spring in the vacuum spark-advance unit. That allowed the spark to advance faster than the throttle opened. I fixed it for the time being by stretching the spring, but you'd better have a new vacuum unit put in."

Palmer's long jaw sagged. For a moment he looked deflated. Then he rapped his head with his knuckles and laughed. "Wrong again. How'd you find out what it was?"

"Added two and two," Gus answered. "They made four just like they always do."

"There's that fallacy again," Palmer said. "I'll prove to you that two plus two doesn't always equal four. Now just suppose . . ."

The shop door banged open. It was Silas Barnstable, lugging his five-gallon can. His seamed face was red and his thin-lipped mouth a straight line.

"I been cheated," he blazed at Gus. "You'll make good or I'll stand you a suit in court. That's what I'll do."

"Now what's eating you?" Gus asked quietly. Joe Clark, attracted by the uproar, stepped out of the office, pencil in hand.

"I been defrauded," Silas grated. "That boy of yours short-measured me on this antifreeze. Soon as I got home I tested it with a hydrometer to make sure he'd given me a fifty-fifty mixture. That was all right. But then I measured it and there wasn't eighteen quarts. No, sir, it was darned near a pint short. I got a refund comin' to me and I'm gonna get it."

Joe looked reproachfully at Greg Jones. "I told you to be careful."

"I was careful," Greg protested. "I measured out nine quarts of antifreeze and nine quarts of water, and I screwed the cap on good and tight so none of it could spill out."

"I believe you, kid," Gus said.

"Then I'm a liar," Silas exploded.

"Keep your shirt on," Gus advised him. "I don't doubt that the mixture was a pint or so short when you measured it. But I don't doubt, either, that Greg measured out nine quarts of antifreeze and nine quarts of water for you."

Joe Clark fidgeted. "I'm afraid he couldn't have, Gus. Nine and nine always add up to eighteen."

"There's that fallacy again," Palmer cut in. "Nine and nine don't always add up to eighteen any more than two and two always equal four. I told you I'd prove it to you. Let me have two quarts of that antifreeze, a two-quart measure, and a gallon measure. I'll prove it right now."

"Go ahead, Greg," Gus grinned. "Get him what he wants. I think Joe and Silas have got it coming to them."

Greg brought the things. Palmer filled the two-quart measure full of water and dumped it into the gallon container. Then he filled the measure with two quarts of antifreeze and slowly began to pour it into the water.

"You saw me put two quarts of water in the can," he said, "and now I'm putting in two quarts of this stuff. Two and two makes four. Or does it?"

With those words he poured the last of the antifreeze into the water. The mixture was well below the one-gallon mark.

"There's your proof," Palmer went on. "Chemists call it 'volume change.' When you mix a cup of sugar and a cup of water, the sugar dissolves in the water and the mixture isn't two cups. It's much less. Two quarts of alcohol and two quarts of water don't add up to fully four quarts. They intermingle and there's a shrinkage of about two percent. In nine quarts of antifreeze and nine of water that's nearly twelve fluid ounces—about a cup and a half."

"Well, I'll be doggoned," Joe exclaimed.

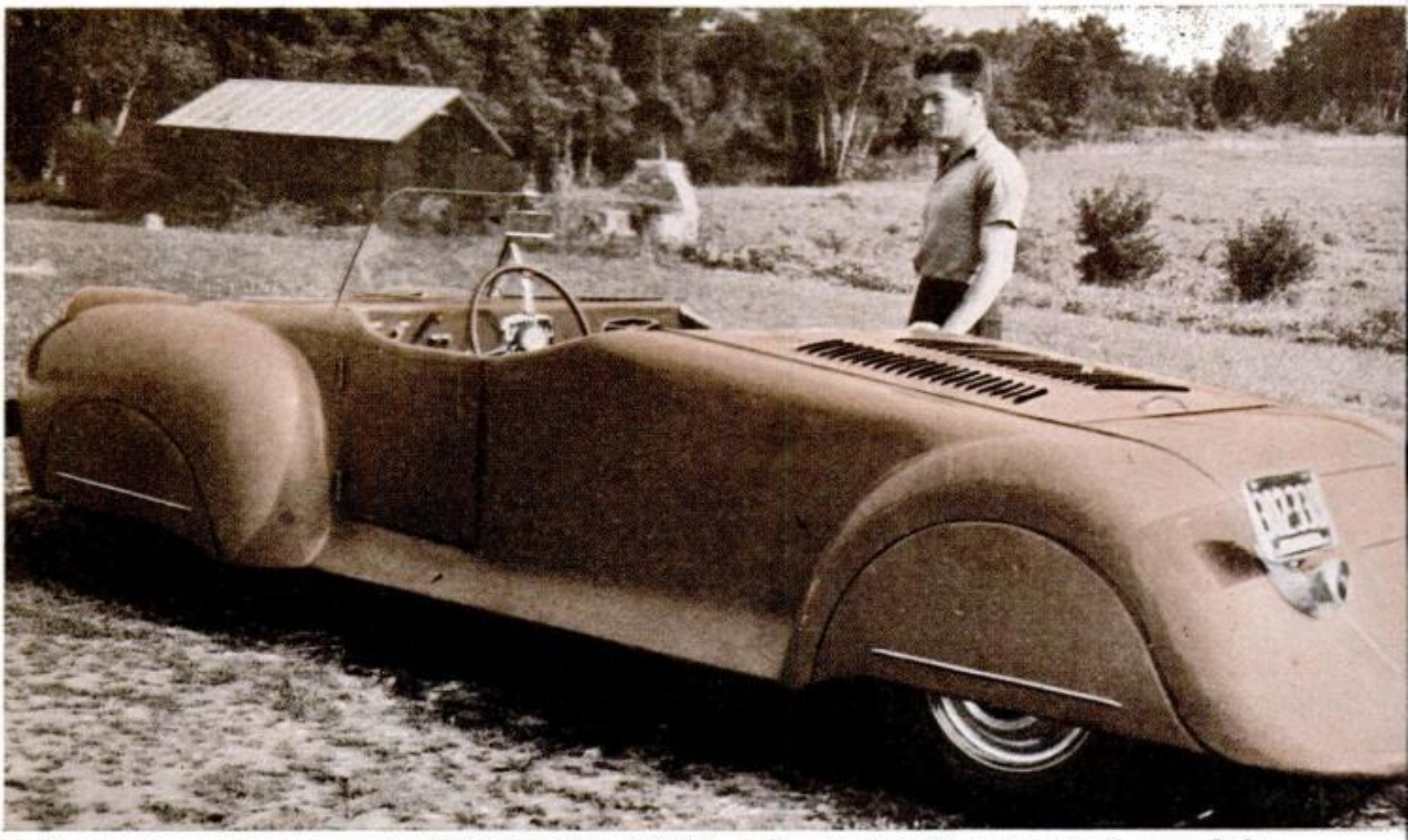
"I wouldn't," Gus said, "because I've seen it happen before and I knew Silas and Greg both could be right. But I'm glad we have a chemist here to make it official. Silas mightn't have believed me."

"Humph," snorted Silas. "Don't know as I do yet. Where I learned figurin', two and two always make four."

Gus looked at Palmer. They both laughed.

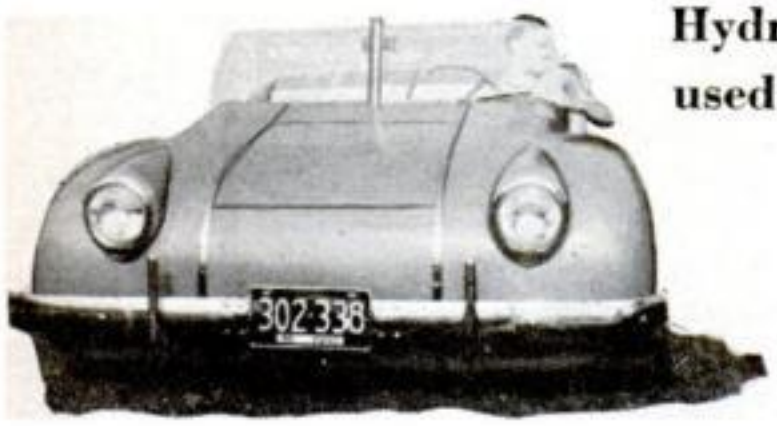
"I guess that's pretty good arithmetic," murmured Gus, "except when it happens to be wrong." END

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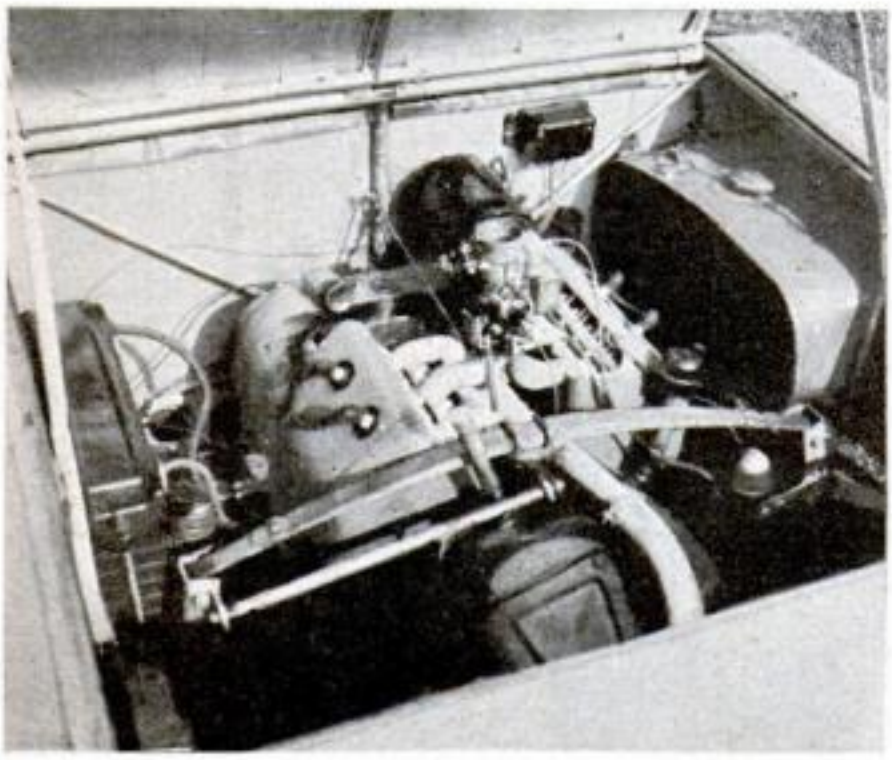
Built at home, the rear-engine "Walker Special" is so low it doesn't quite reach your belt.

$250 and 3000 Hours

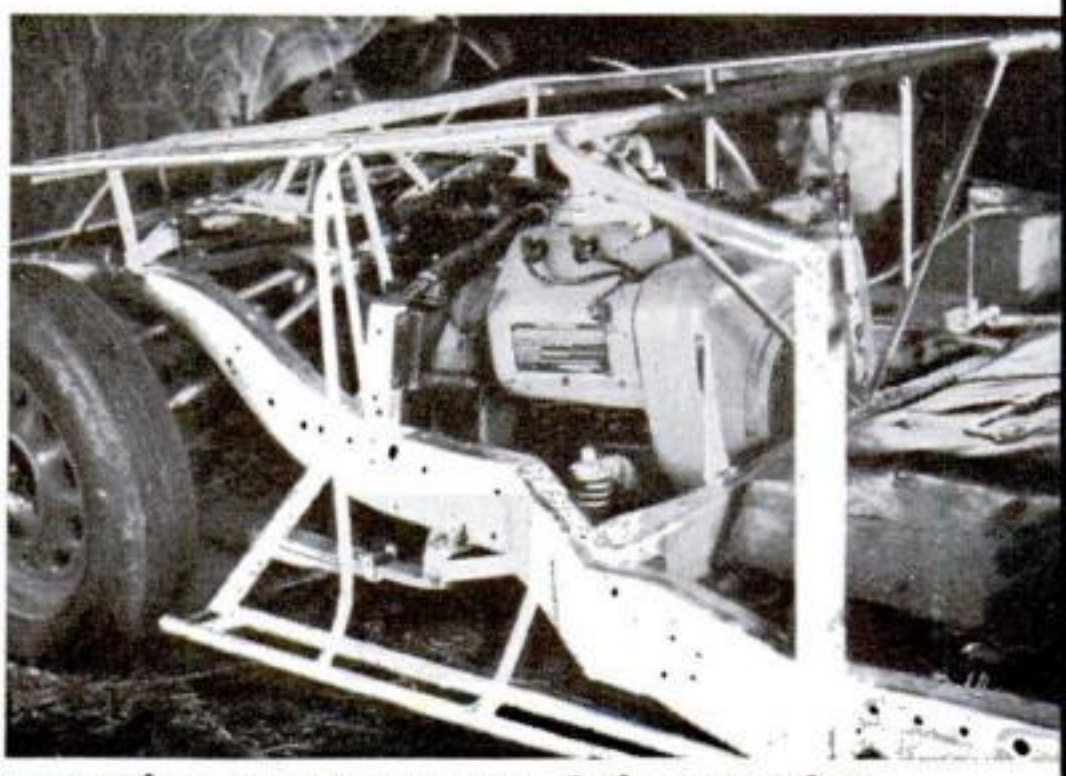


Hydraulic controls and rear-mounted engine are used in this homemade, road-hugging automobile.

PUT back your pocketbook. At first glance, you may have hoped this was a car you could buy. But it's not for sale, nor any other like it. However, if you're a master

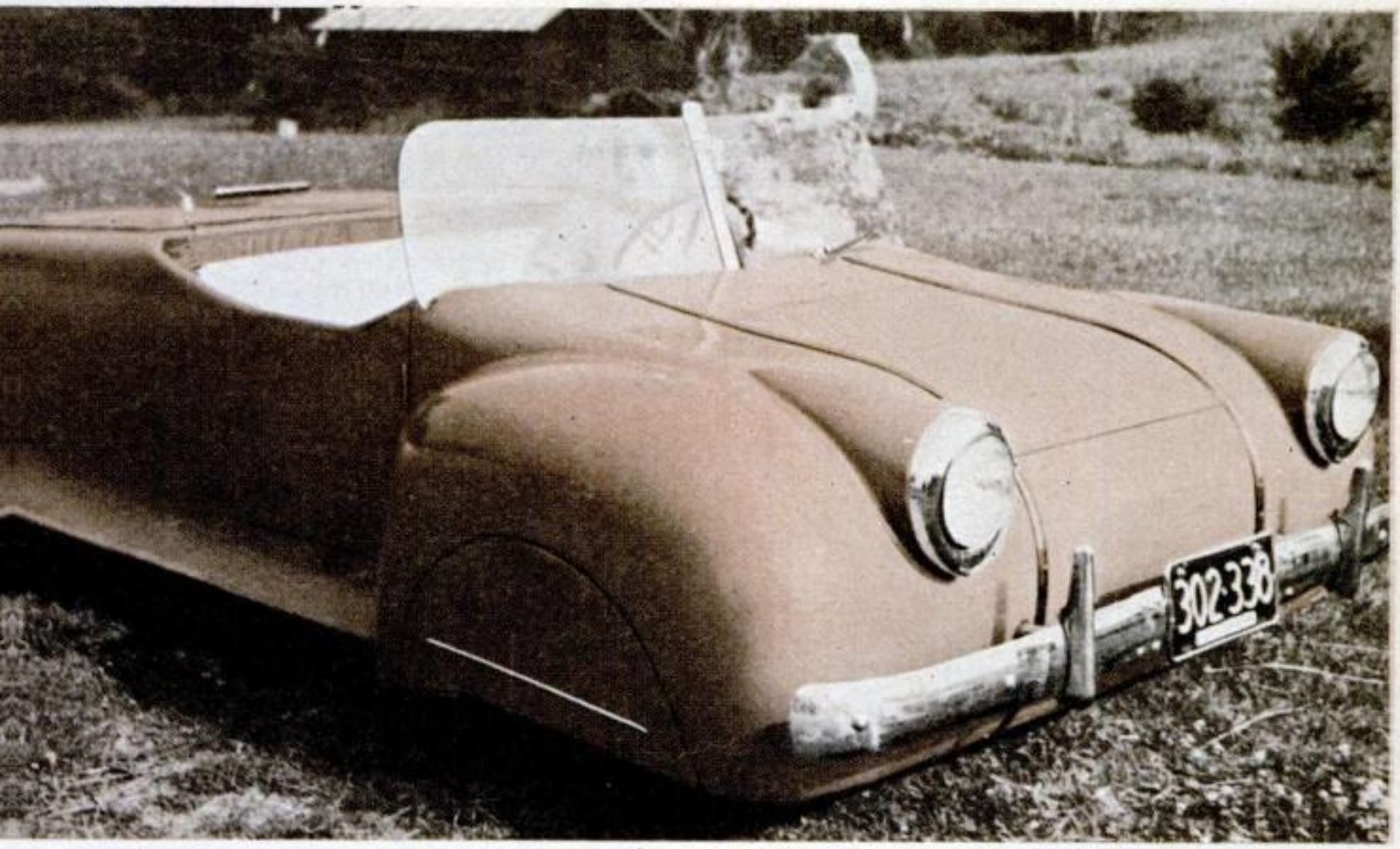


Air-cooled engine rests on springs. The first ones installed had to be beefed up to prevent



torque from twisting engine. Coils are used at the front (above), a cantilever at rear (left).

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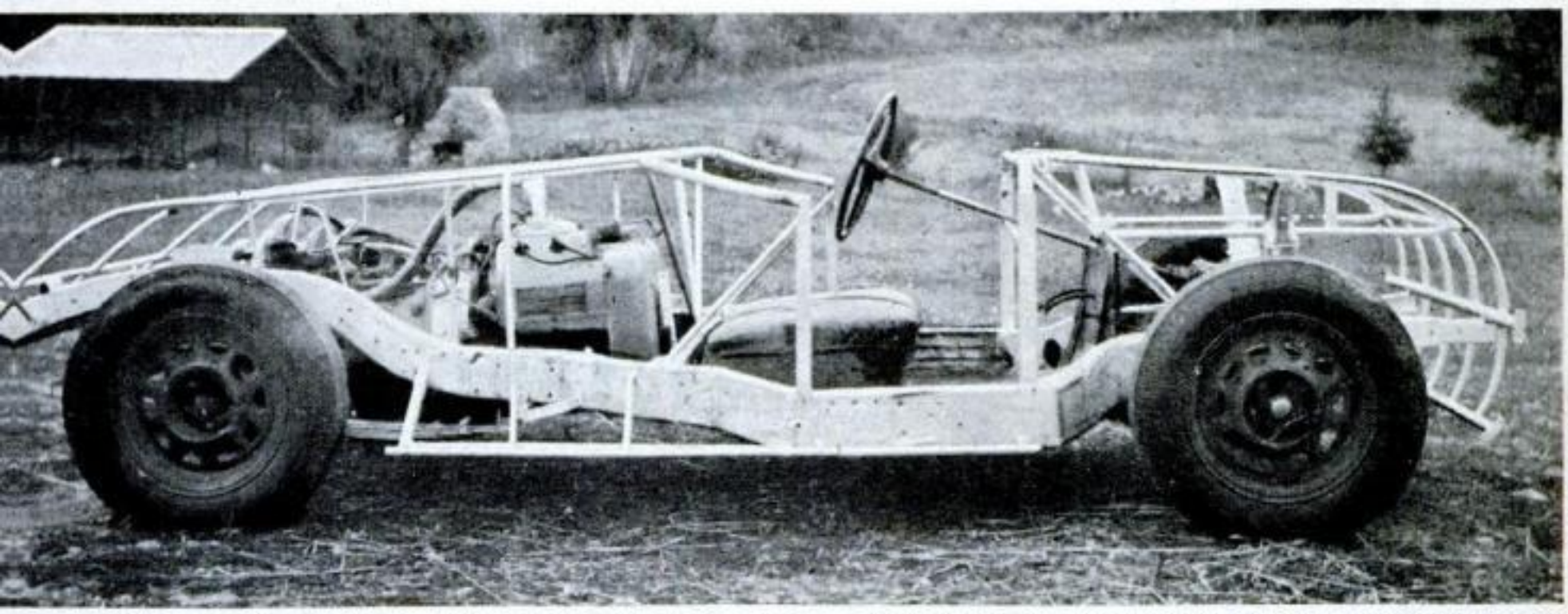
Although hammered out by hand, the sheet-metal body is smooth and entirely free of ripples.

Produce a Dream Car

mechanic, you might duplicate it for about $250. That's about what Paul H. Walker, of North Oxford, Mass., spent for materials.

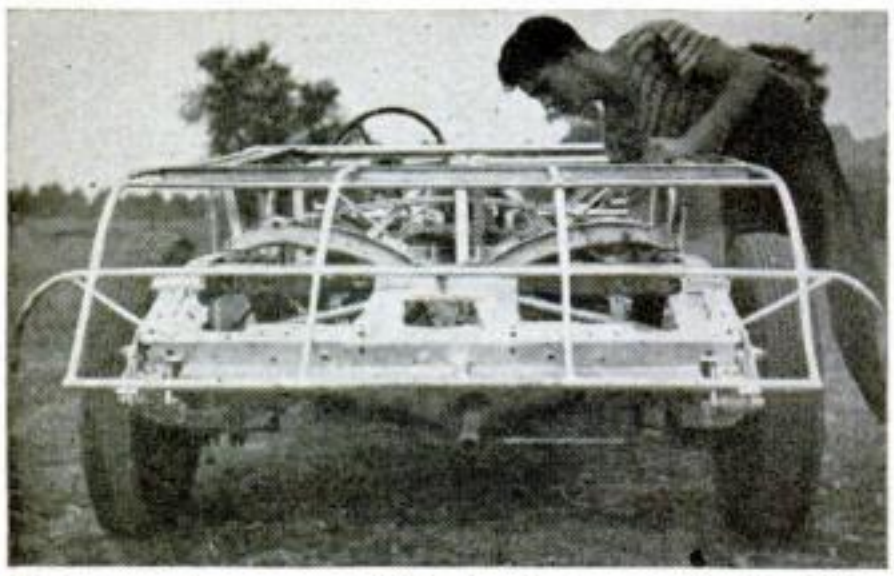
The hitch is the job took him some 3,000 hours. Even so, the builder had a lot of able assistance. His wife worked right along with him, and the neat upholstery is entirely her handiwork. At last report, she was working on the finishing touch—a canvas top with a zipper closure through which they'll enter and leave the car.

Registered as the "Walker Special," the light-green roadster is powered by an air-cooled V-4 engine set in the rear of the chassis. Designed for a fire pumper, the engine develops 20 hp., gives about 40 miles

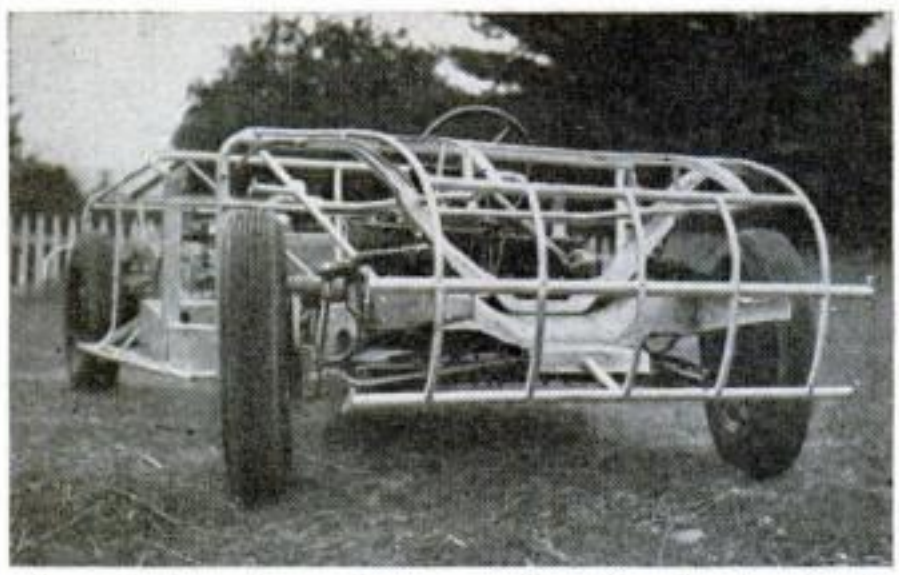


Steel tubing salvaged from two wrecked planes was cut, bent, and welded to form a framework for the body. Not a single bolt was used. The wheels and main frame came from a junked car.

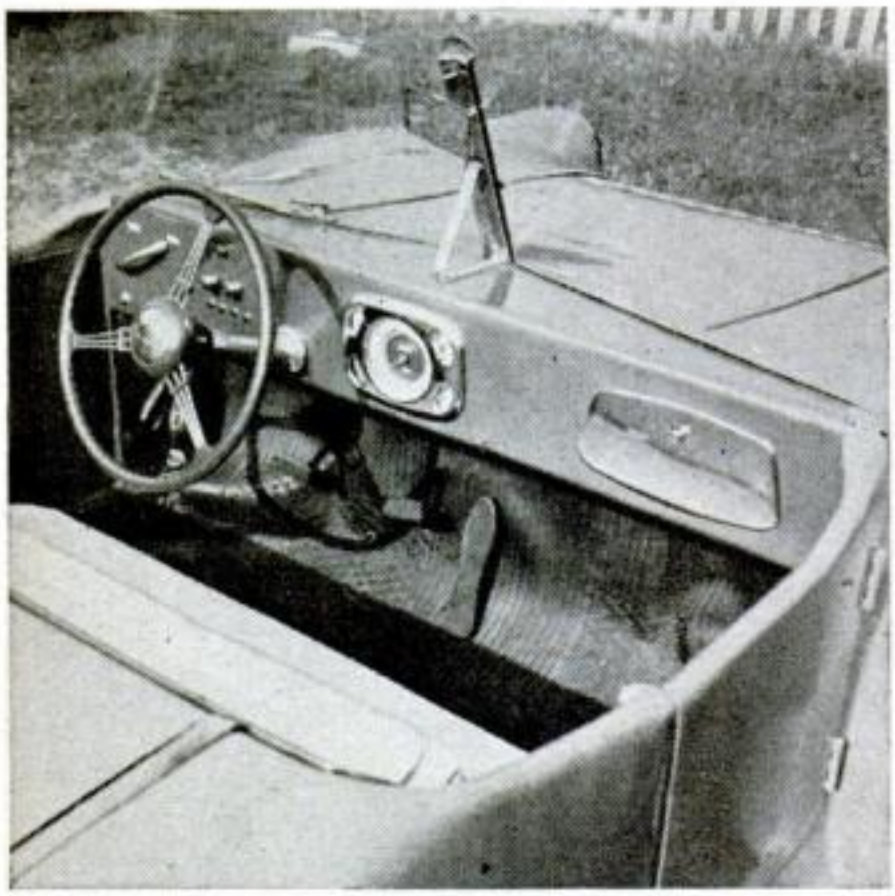
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Extreme lowness of the body is emphasized by way the builder must reach down to the engine.



Ample turning clearance for the front wheels was obtained by making the fenders extra wide.



Instrument panel is chrome plated. The builder had the rimless windshield cut to his design.



Valves make things easier for driver. Clutch and transmission are hydraulically controlled.

per gallon, and has driven the car at 55 m.p.h. while still far from wide open.

A foreman in a tool and die shop, Walker cuts, bends, and welds husky steel channel as casually as a carpenter saws and nails two-by-fours. Starting with a frame and wheels from a junked 1935 Plymouth, he widened the frame 20″, lowered it 6″, and installed a body frame cut and bent from steel tubing salvaged from two wrecked planes. The wide seat takes four.

Shaped by hand, the sheet-steel body looks as good as anything you might get from a factory. This is all the more remarkable since the body was the first major sheet-metal job the mechanic-builder had ever tackled. There was one false start. Finding he couldn't turn out a really fine job with steel of the same gauge used in commercial bodies, he scrapped what he'd done and used a slightly heavier gauge.

Selector-valve controls on the instrument panel help the driver operate the car. Both the clutch and transmission are operated by hydraulic cylinders that Walker made by reaming out gas pipe. Under the hood, in addition to the spare tires, there's the hydraulic system and a vacuum booster diaphragm. The latter holds down the clutch while the car is waiting for a light to change.

Under-car ducting was installed at first to feed cooling air to the engine, but this didn't supply air in sufficient volume. The low clearance prevented use of an under-car metal air scoop, but that didn't stop Walker. He cooked up a spring-supported canvas panel that feeds all the air that's needed and isn't damaged if the car bottoms on a rutted road.

In addition to the usual three-forward and one-reverse transmission, the Walker Special has a two-speed rear axle with a manual shift. This gives a total of six speeds forward and two in reverse. END

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Mechanics and Handicraft

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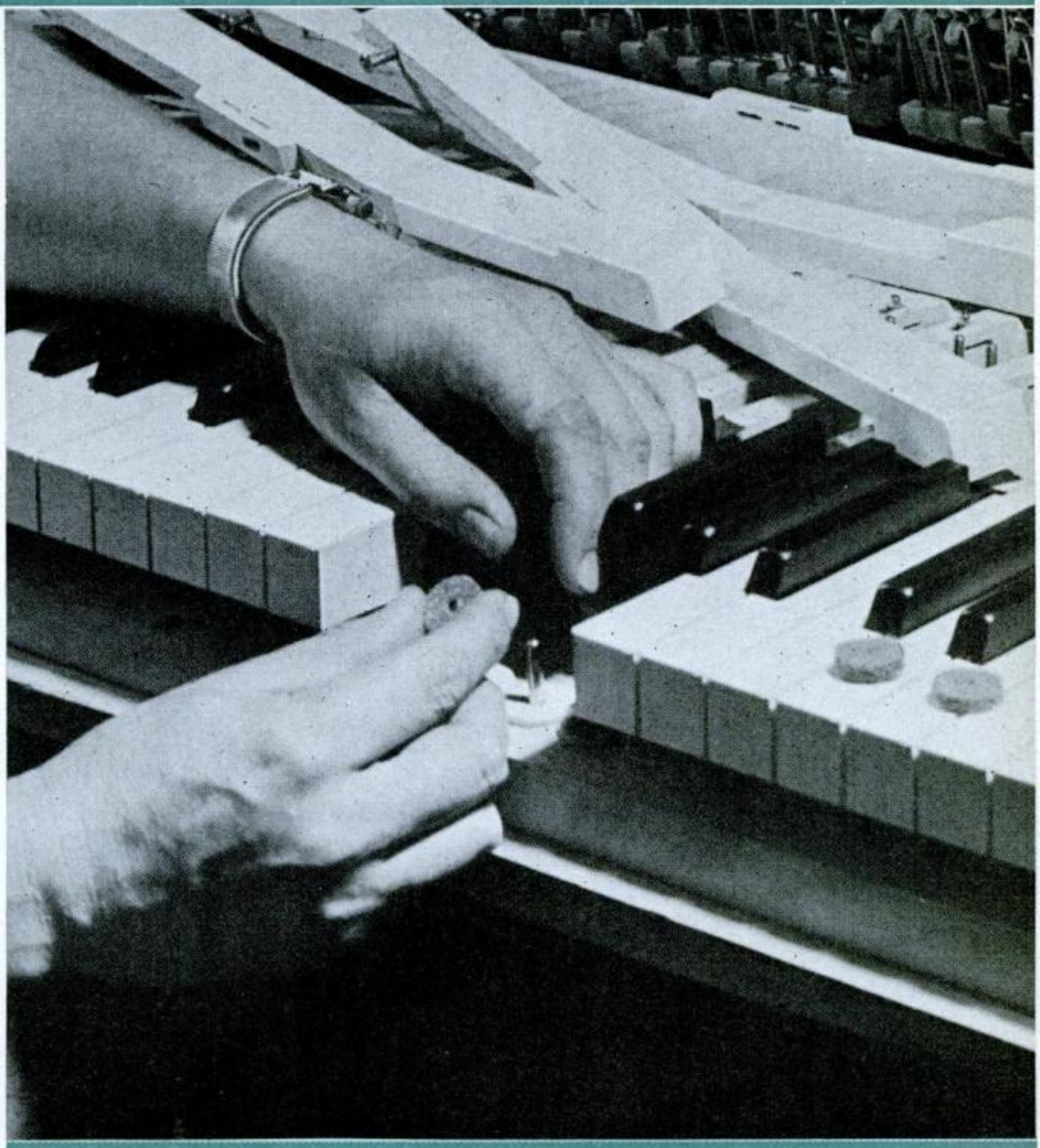
Repairing Old Pianos PAGE 228

Tiny Train Has Ratchet Drive PAGE 190

Working Model Hot-Air Engine PAGE 194

How to Take Pictures of Glass PAGE 216

Wireless Mike Sends to Radio PAGE 224



Leveling keys with felt punchings is among the piano repairs you can do. Page 228

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IT'S A GIFT

Plastic Box Framed in Copper



Better make several of these copper-cornered boxes. You'll want one yourself, and extras will fill those gaps in your Christmas list.

Two popular craftwork materials are neatly blended in this attractive candy or cigarette server.

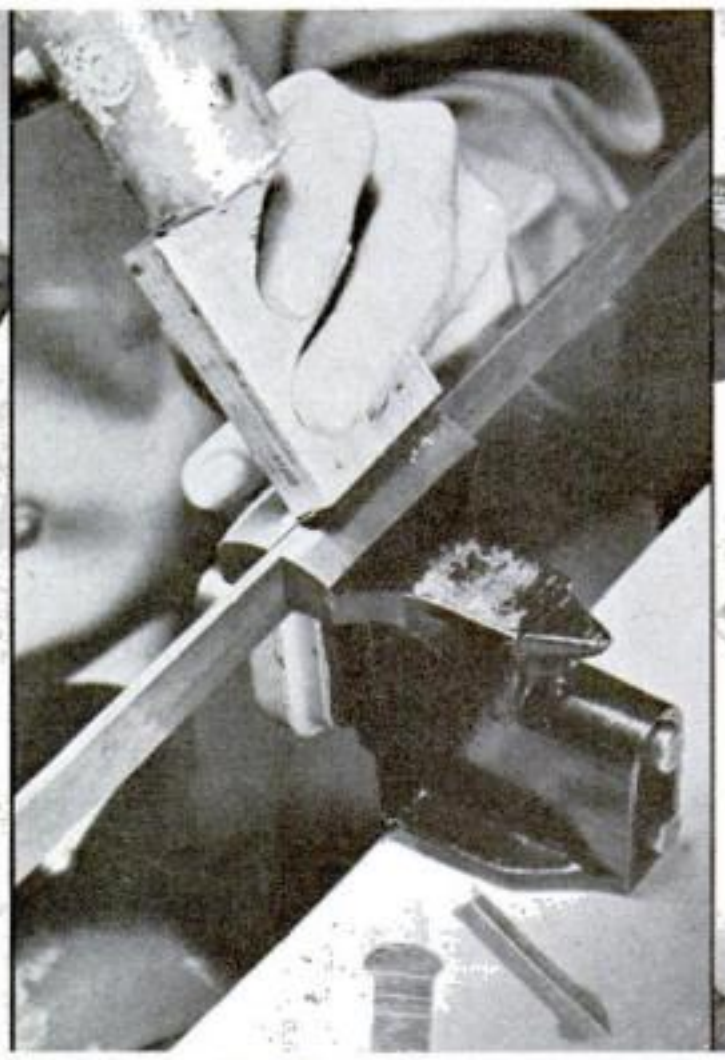
By Bill Luther

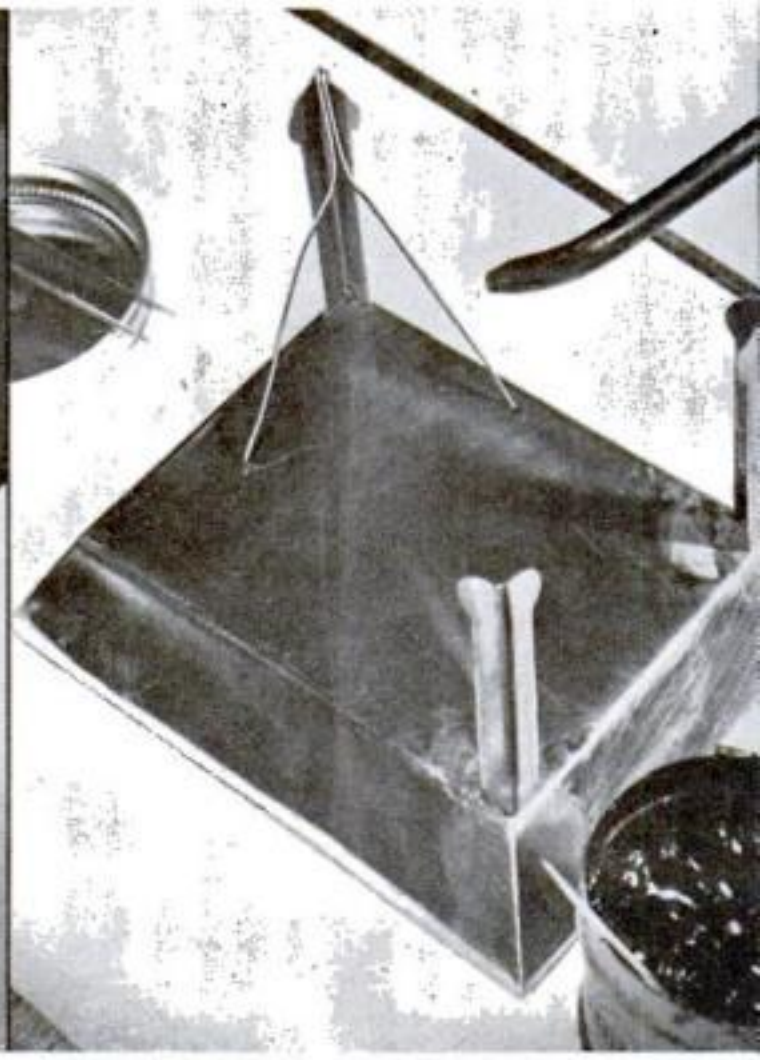
GLISTENING copper and transparent colored plastic combine their lusters in this cleanly styled cigarette box. It will hold either regular or king-size smokes, or serve as a candy or jewelry box.

The base, frame members, and floral escutcheon on top are made from 18- or 20-gauge soft copper. In laying out and cutting the copper, be sure to get the outlines, corners, and bend lines accurate. Smooth the cut edges with a file, flatten the blanks on a metal plate, and anneal them by heating red hot. Quench in a weak pickling solution of sulphuric or nitric acid and water. This removes scale and dirt.

Bend the metal to shape in a vise and solder the joints and seams on the inside. Buff the copper thoroughly with tripoli, finishing with jeweler's rouge.







Clamp the base in a vise, as at left, and make the stiffening and 45-deg. corner bends. Corner posts are hammered over along the centerline. Back them in the vise with a square-edged bar (center) and use a smooth block between the work and the mallet. A wire holding jig will help in soldering the posts to the base. Put a chip of solder at the corner and flow it in.

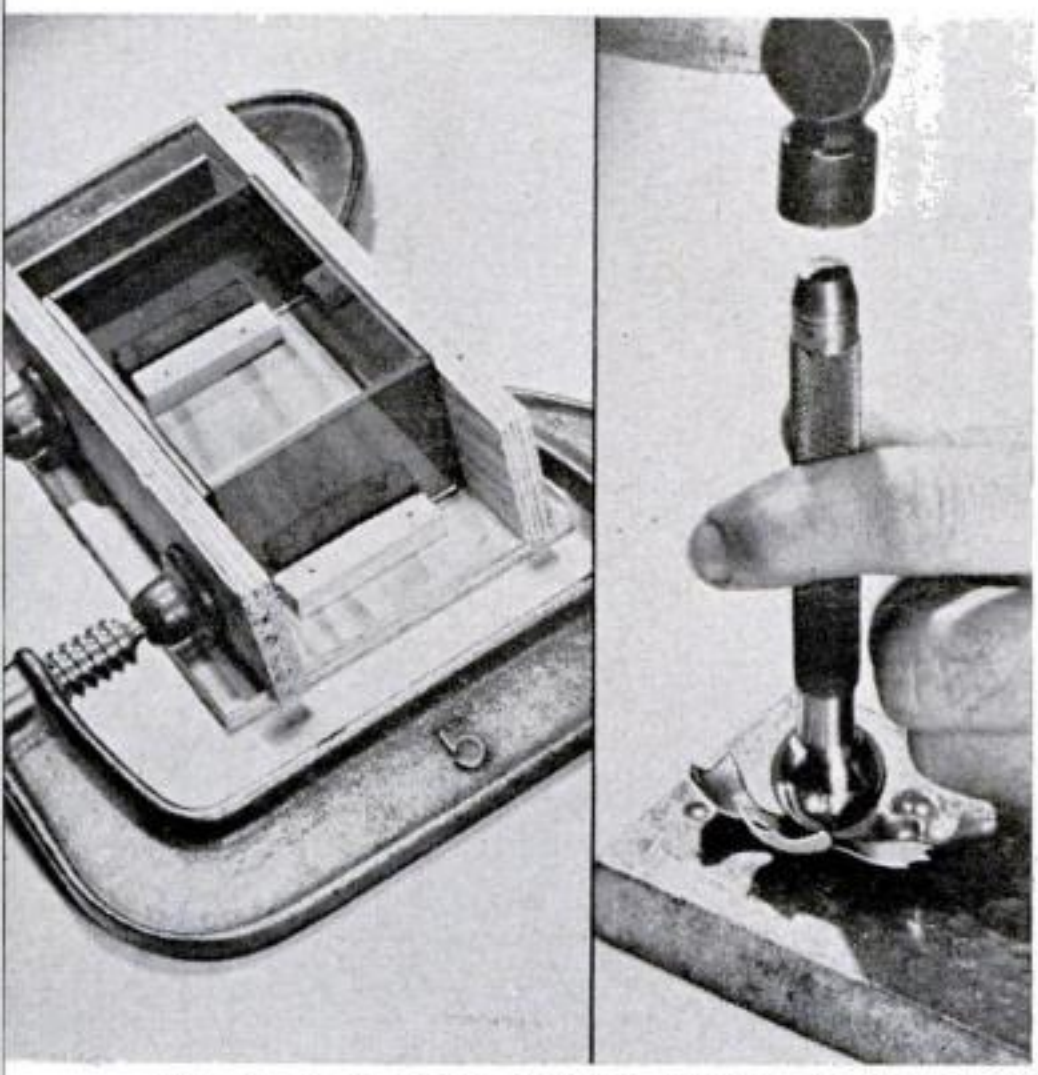
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The box itself is constructed of ⅛" plastic. Two 2" by 4" pieces are needed for the sides and two 2" by 3" for the ends. A single 3¼" by 4" rectangle is required for the top. Saw the plastic just a bit over these dimensions. Lay a file on the bench and "joint" the plastic edges true and square by rubbing firmly against the file. Repeat the operation with fine sandpaper.

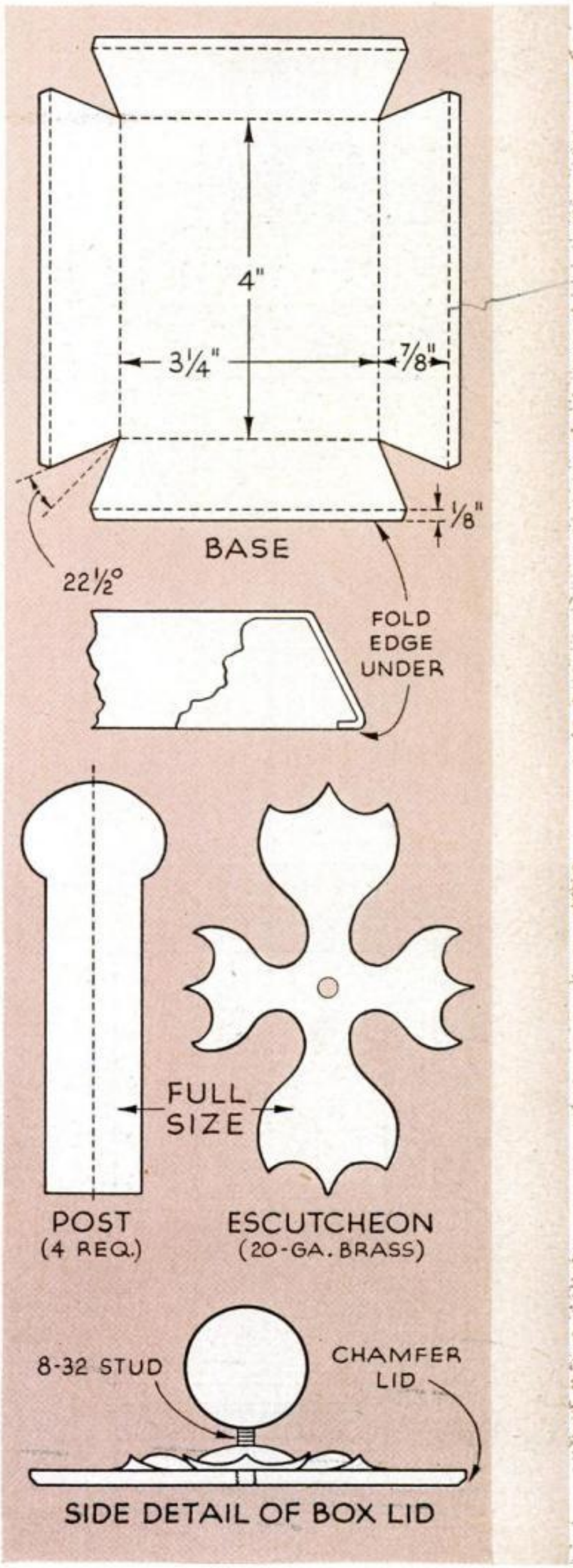
A wooden jig will simplify the assembly of the plastic pieces. Apply plastic cement, butt the longer pieces outside the shorter ones, and clamp them solidly until they dry. When the cement has set, round off the lower corners to clear the solder at the bottom of the corner posts. Sand all plastic edges with fine-grit paper and buff them until they become transparent.

A ⅞" copper ball that turned up in the junk box became the lid handle, but almost any similar object could be used here with good effect. Thread a stud into the ball, drill through the escutcheon and lid, and thread the hole in the latter to suit the stud.

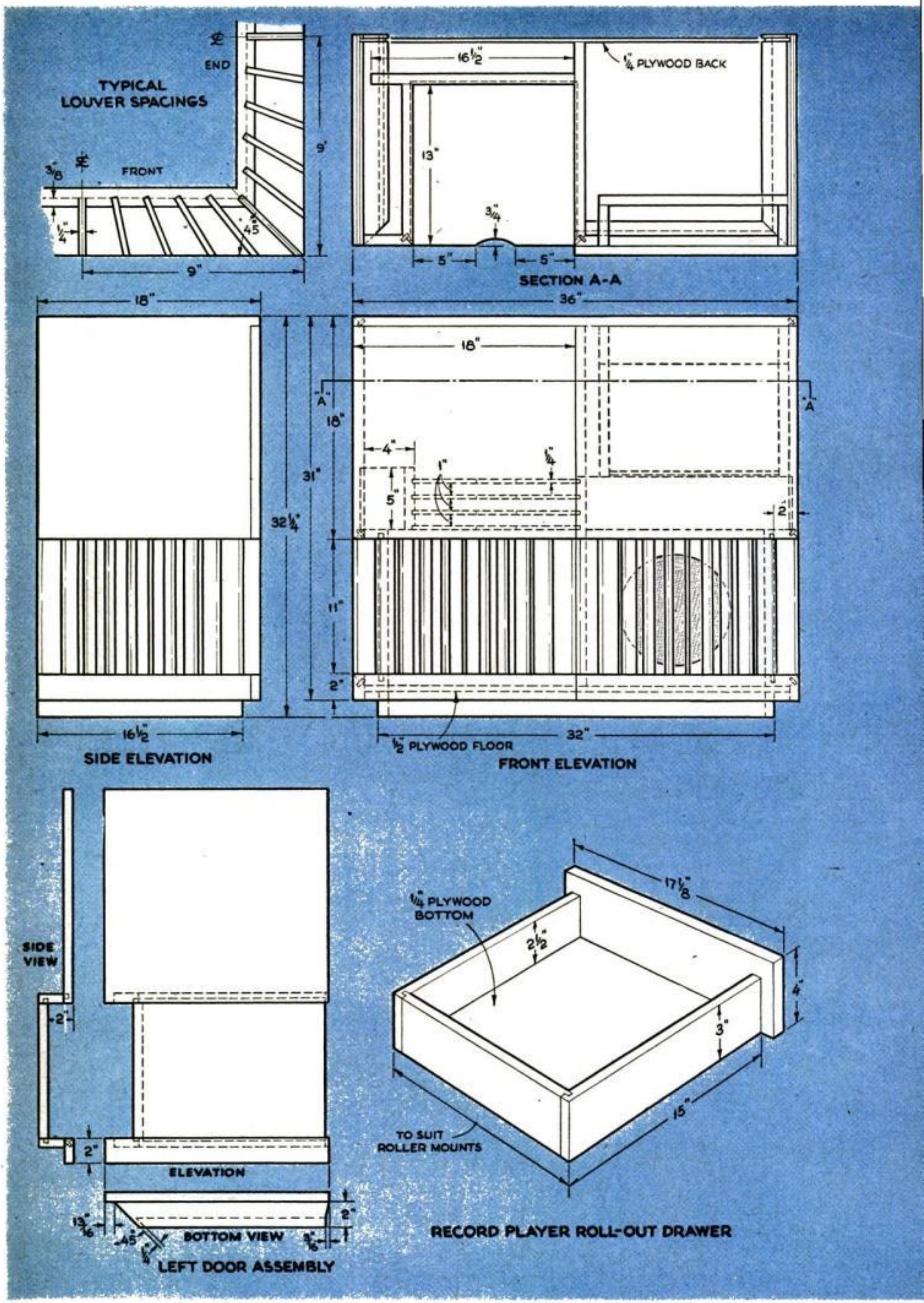
Chamfer the underside of the lid so that it will seat easily within the flared corners of the posts; then remove the box and burnish all the metal parts. Apply a coat of clear lacquer to retard tarnishing. A dab of cement along the lower edges of the plastic will keep it firmly in place. END



An assembly jig, left, is good for cementing the plastic sides and ends. The escutcheon is given its raised effect by hammering with a ball-ended punch over a lead block.



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Modern Radio-Phono Cabinet Built Around Old Set

By Bernard I. Bell

THERE are many reasons for assembling your radio phonograph from separate units, and all of them spell value. Low-priced tuners, record changers, amplifiers, and speakers often surpass in quality the comparable parts of upper-bracket combination consoles. In addition, you may be able to salvage one or more of the four parts from equipment you already have.

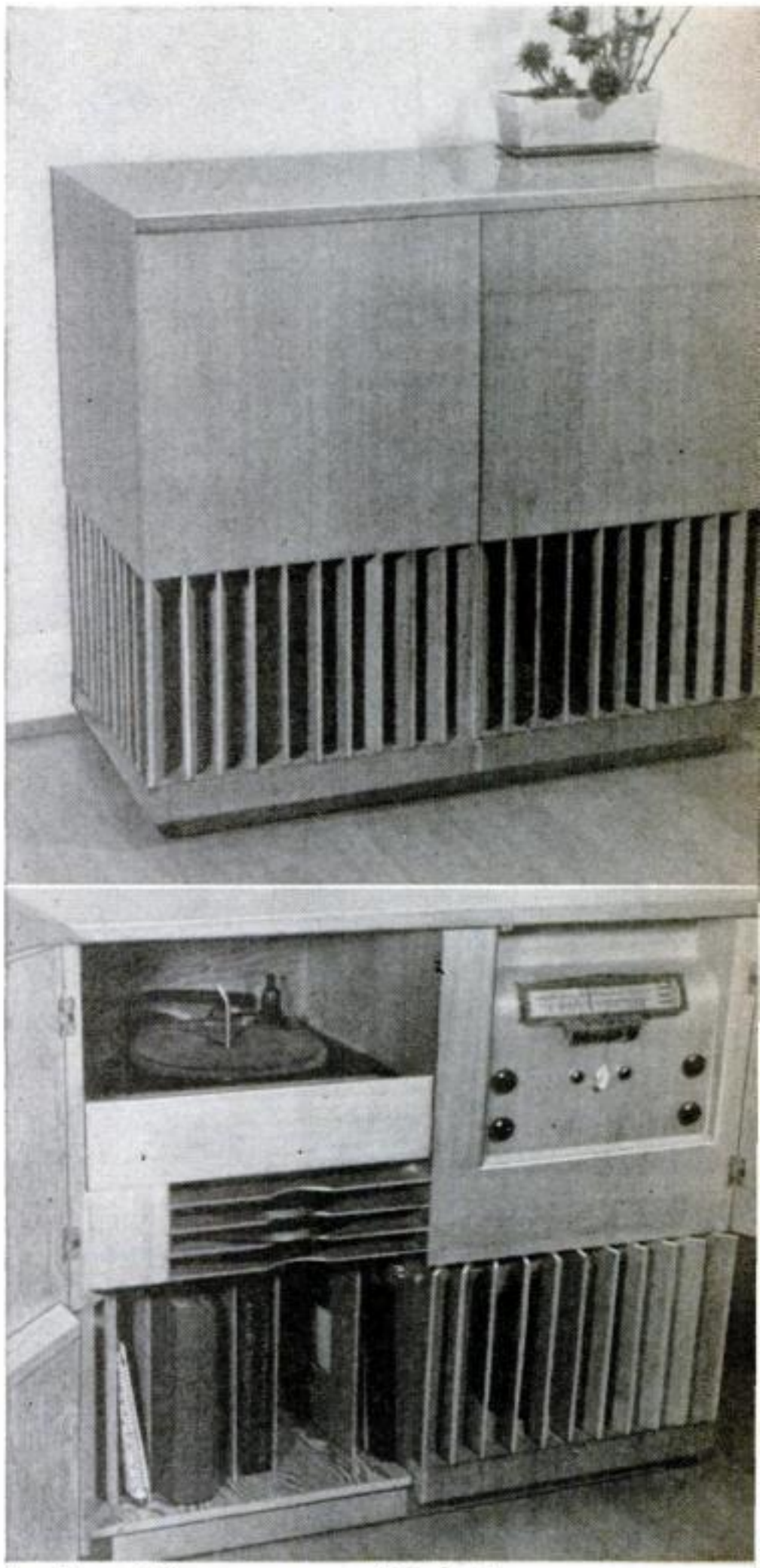
Perhaps your problems can be solved by just adding an automatic record player to an otherwise good radio; maybe it's FM that you want in your new setup, or a new loudspeaker to banish the old, tinny sound. Whatever you have to start with, and whatever you want to add, you can save yourself a pretty penny by doing the job yourself.

The photos and drawings on these pages show how I modernized my odds and ends of radio apparatus into an integrated combination. The record-player drawer is mounted on commercial ball-bearing slides, while the radio and its front panel were taken from an old set and fitted into the new cabinet. Both radio and player are connected to a double-pole, double-throw switch by plugs.

The cabinet was built of 13/16" plywood with mahogany veneer on one side. The louvers, record shelves, and partitions are ¼" solid mahogany. All exposed plywood edges—such as the front edge at the top of the cabinet—were concealed with mahogany veneer. Mitered spline joints were used wherever possible to reduce the amount of edge veneering.

Grooves for the back edges of the louvers are cut at angles in the vertical pieces of the louver housing, not in the horizontal parts. After the louvers were cut and fitted into their grooves, they were marked on both sides. Then the portions to be glued were masked during finishing operations.

When the cabinet was completed, except

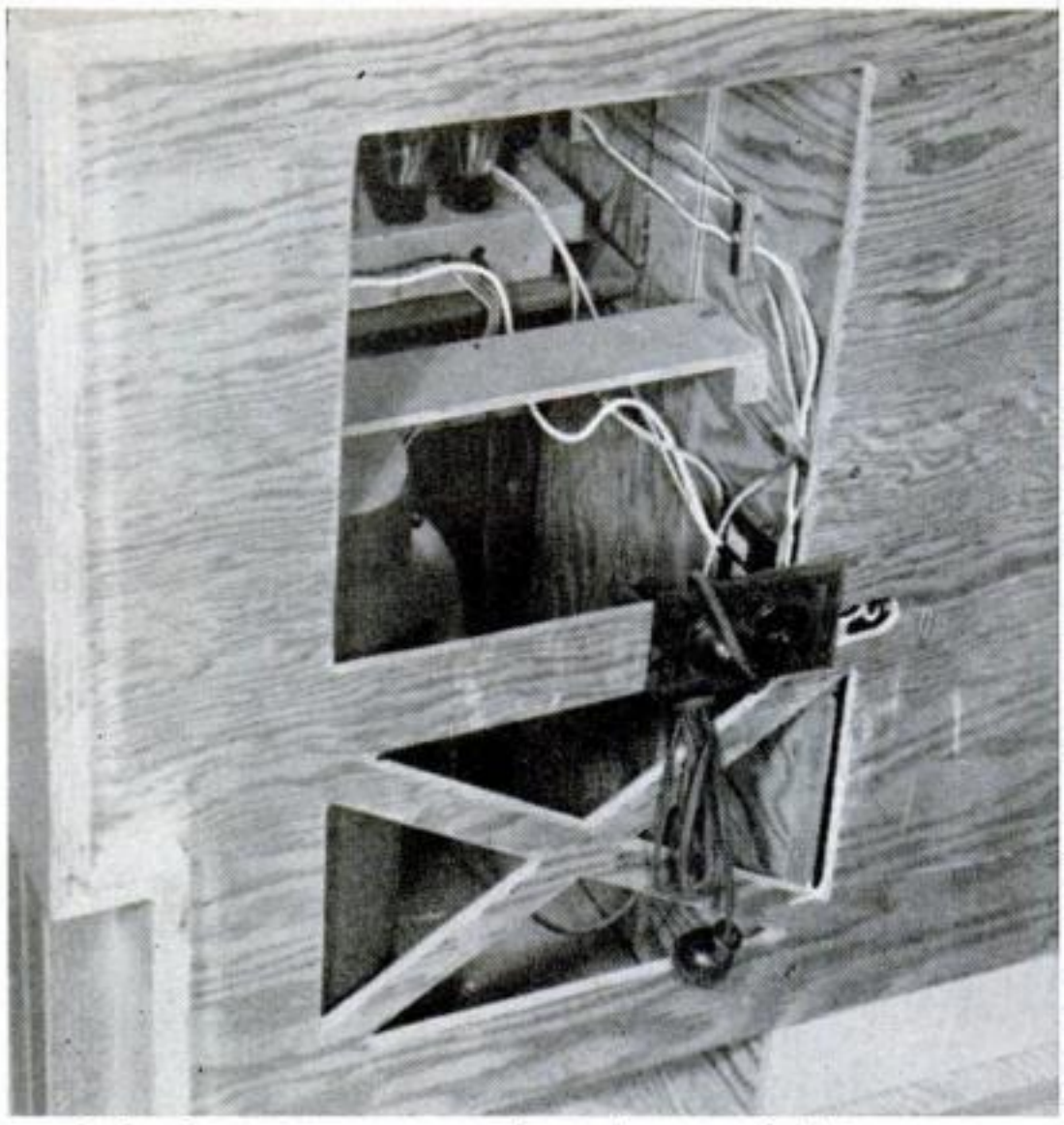


As the cabinet was assembled, the necessary supports for the radio chassis were fitted in. The speaker is mounted beneath the radio and behind an opening in the louvered panel at right.

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This is the bottom of the door enclosing the record-player side of the cabinet. The corner louver swings with this door.

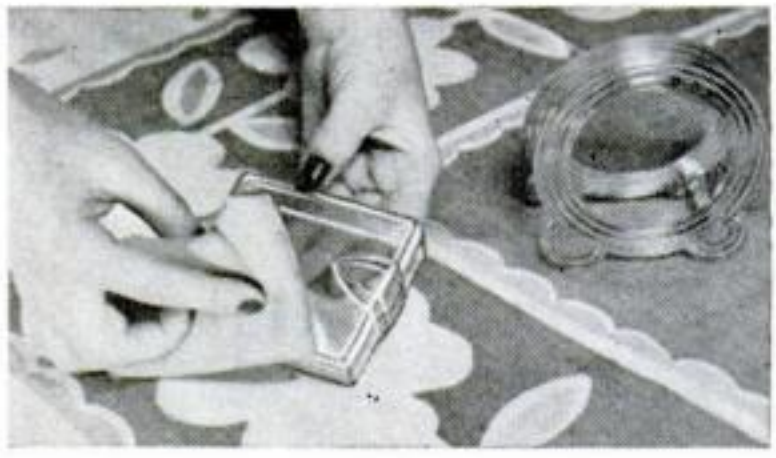


With both units connected to the switch by plugs, either one can be removed from the cabinet without disturbing the other or the switch.

for fitting the louver boards, it was given a lacquer finish. During this operation, the louver grooves were filled with scrap lumber to keep them clean and ready for glue.

I first applied a commercial wood bleach and then a quick-drying paste wood filler of natural color. A coat of lacquer sanding sealer was sprayed on, and when dry, sanded lightly and dusted thoroughly. Next, several coats of semigloss clear lacquer were sprayed on with wet sanding between coats. The final coat was rubbed with pumice and oil to a glasslike finish. Lastly, a coat of furniture wax was applied. END

CARING FOR PLASTICS [SHIPSHAPE HOME]



SINCE the surface of articles made of Lucite® and Plexiglas® is relatively soft, no abrasive cleaners should be used on them. Lukewarm water and soap will clean these plastics. Excessive heat is harmful, so do not expose them to flame or use boiling water on them.

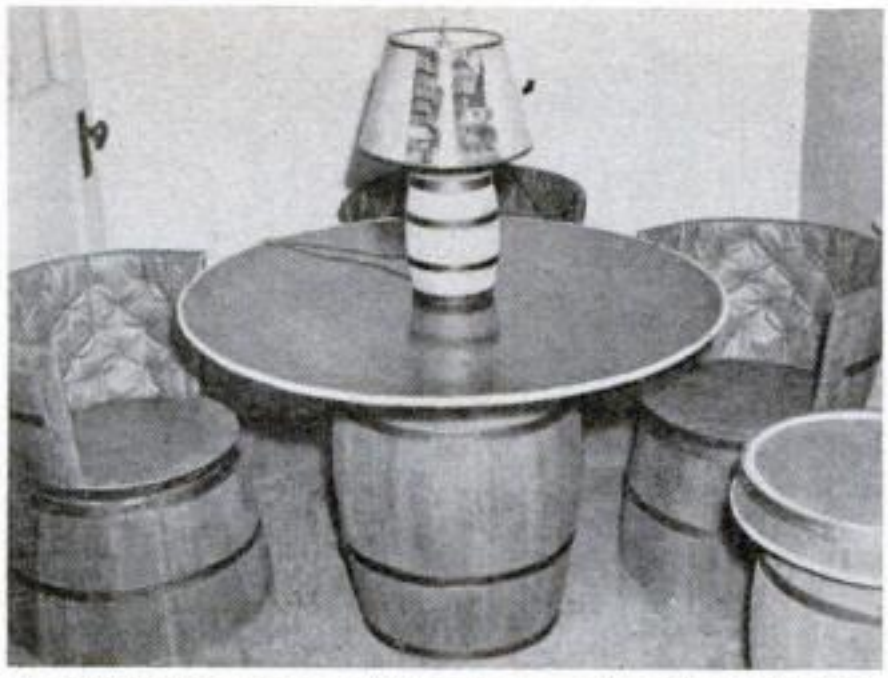
First rinse the article to be cleaned with water. Then sponge it with soap and water, and again rinse it with clean water. Use only a cloth or sponge that is free of grit or dirt. After washing, wipe the article with a clean, slightly damp chamois, a pad of absorbent cotton, or a clean flannel cloth.

Avoid use of window cleaners, benzene, denatured alcohol, and household cleansers, since these contain solvents or abrasives harmful to plastic. Also avoid spot removers and nail-polish removers. These usually contain solvents that may attack plastic.

Finally, to bring out the sparkle in plastics, apply paste wax and polish gently with a clean cloth. Do not rub too hard because this creates a charge of static electricity on the article that attracts dust. This can be avoided by using a special wax that prevents the formation of static electricity.

POPULAR SCIENCE MONTHLY SHOP DATA

1413



Artificial-leather upholstery, a hardwood table top, and an oak-cask lamp form this ensemble.



Spraying stain on a barrel chair. Clean, well-seasoned hardwood staves get a natural finish.

Furniture Maker Uses Barrels

THE general store may lose some of its popularity when confirmed barrel-sitters discover they can have the same masculine furniture right in their own homes. These models, made by the Bob Company, St. Joseph, Mo., are even more comfortable, for they've been given backs, arm rests, and upholstery.

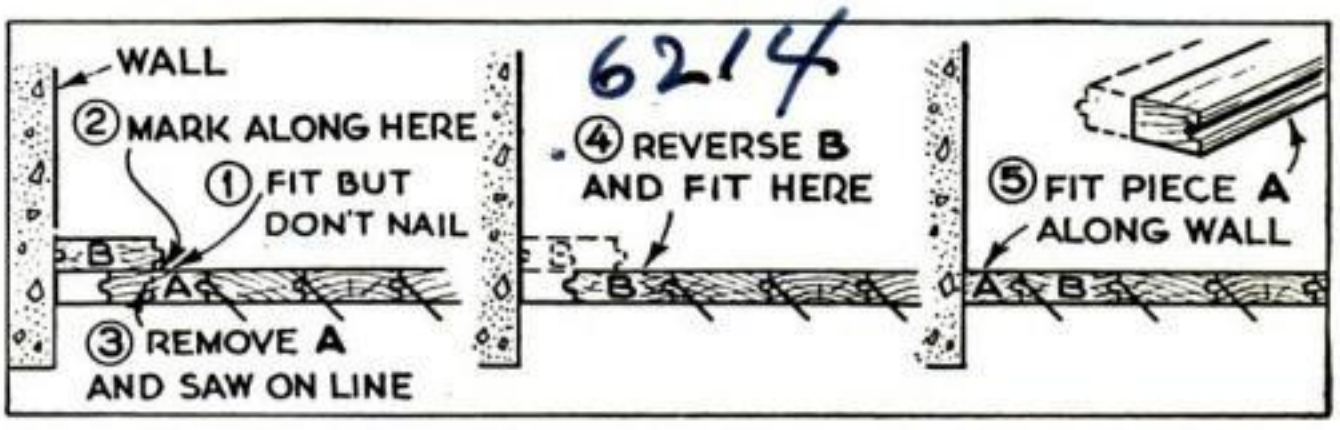
Barrels are particularly suited for chairs, ottomans, tables and the like. Even within the fixed barrel shape there is plenty of opportunity for variation in style. Note, for example, the armchair being spray-finished in the upper right-hand photo. Arm and back space has simply been cut out of the upper half, leaving the original barrel contour. The flare-armed chair behind the operator, on the other hand, was made by sawing the barrel in half and putting the bottom on top.



Tacking a layer of padding in a barrel seat. Upholstering is the hardest portion of the job.

Plank Cut to Size Fits Floor Flush from Wall to Wall

AN EASY way to fit floor planks from wall to wall is illustrated in the three sketches at the right. The last full-size plank (A) is put in place but not nailed. Lay another plank above it with the grooved end flush with the wall and mark off the excess width on A. Turn over and fit in the marking piece, B, and rip the marked plank to the line. The tongued part is the waste. The grooved part should then fit flush with the wall, giving a clean, professional appearance.—*Richard G. Brophy, Santa Fe, N. Mex.*



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What's Your Ingenuity Quotient?



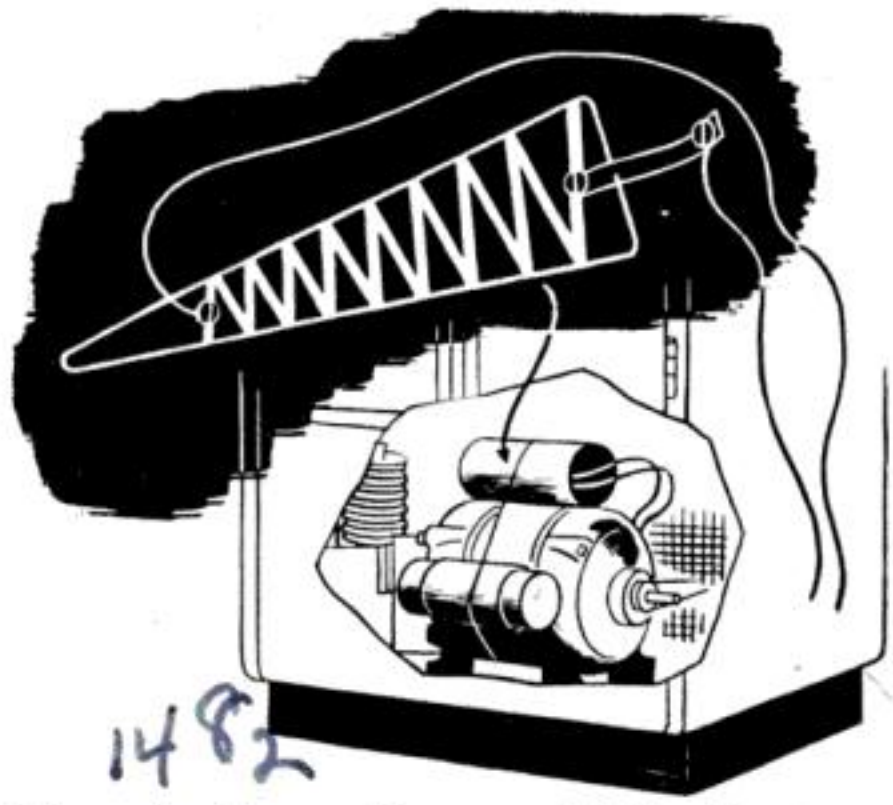
"Don't gum up the works," my wife warned when I set out to seal the bottom holes of some highly glazed flower pots. But that's just what I did. After unsuccessfully trying various sealers, I found that well-chewed bubble gum stuck tightly to the smooth surface. The children did the chewing.—*H. W. Squires, Virginia City, Nev.*



A booby trap was the answer to dogs upsetting our garbage pail. I screwed a mouse trap to the lid, tied one end of a string to the trigger and the other end to the pail, and glued an explosive cap to the trap. Whenever the lid is removed, the cap fires—scaring the dogs away. Forget the whole business if you have a nervous garbage collector.—*Roy Nilson, Fords, N. J.*



Our milkman, besides clanking a lot of bottles together at 5 a.m., also starts our furnace. When he pushes the window open, the cable slackens and a piece of iron runs down the chain. When he closes the window, the iron catches the chain and opens the draft.—*F. A. Robbins, Red Hook, N. Y.*



Here's how I saved the bacon when the starting condenser of our refrigerator motor failed: I wrapped half an electric-iron element in asbestos and connected it as a resistor in place of the condenser. This gave enough phase lead to start the capacitor motor.—*W. R. Percival, Toronto, Ont.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

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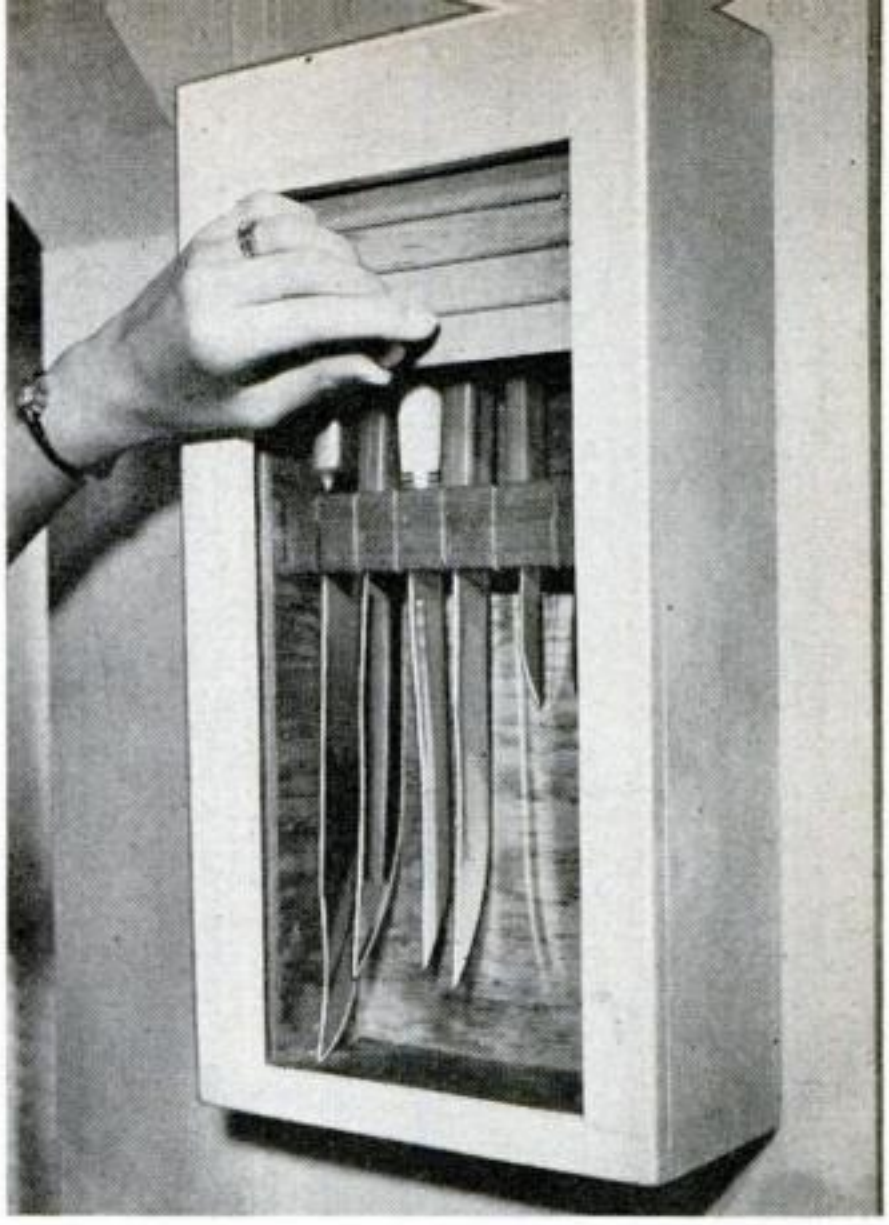
Roll Front Closes Cutlery Cabinet

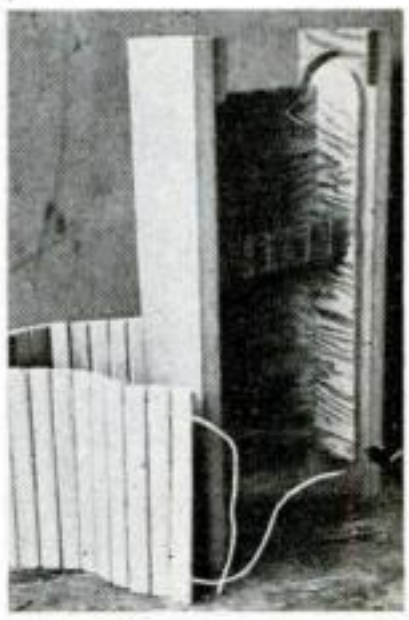
A SLIDING door made of 22 slats laced together by rubber-covered stranded wire encloses the front of this knife cabinet. All the work can be done with hand tools, although power tools help in sawing and drilling.

Make the two roller guides and caps first, cutting them from ⅜" plywood. Then cut the two sidepieces from ¾" plywood. Next nail and glue the guides to the sides, leaving ⅜" on each side for the roll front. Fit the guide caps, as shown, to leave a ⅜" channel. Cut the false back next, and then nail and glue the bottom and sides to it. When you saw out the true back, be sure to make the hanging lugs part of it.

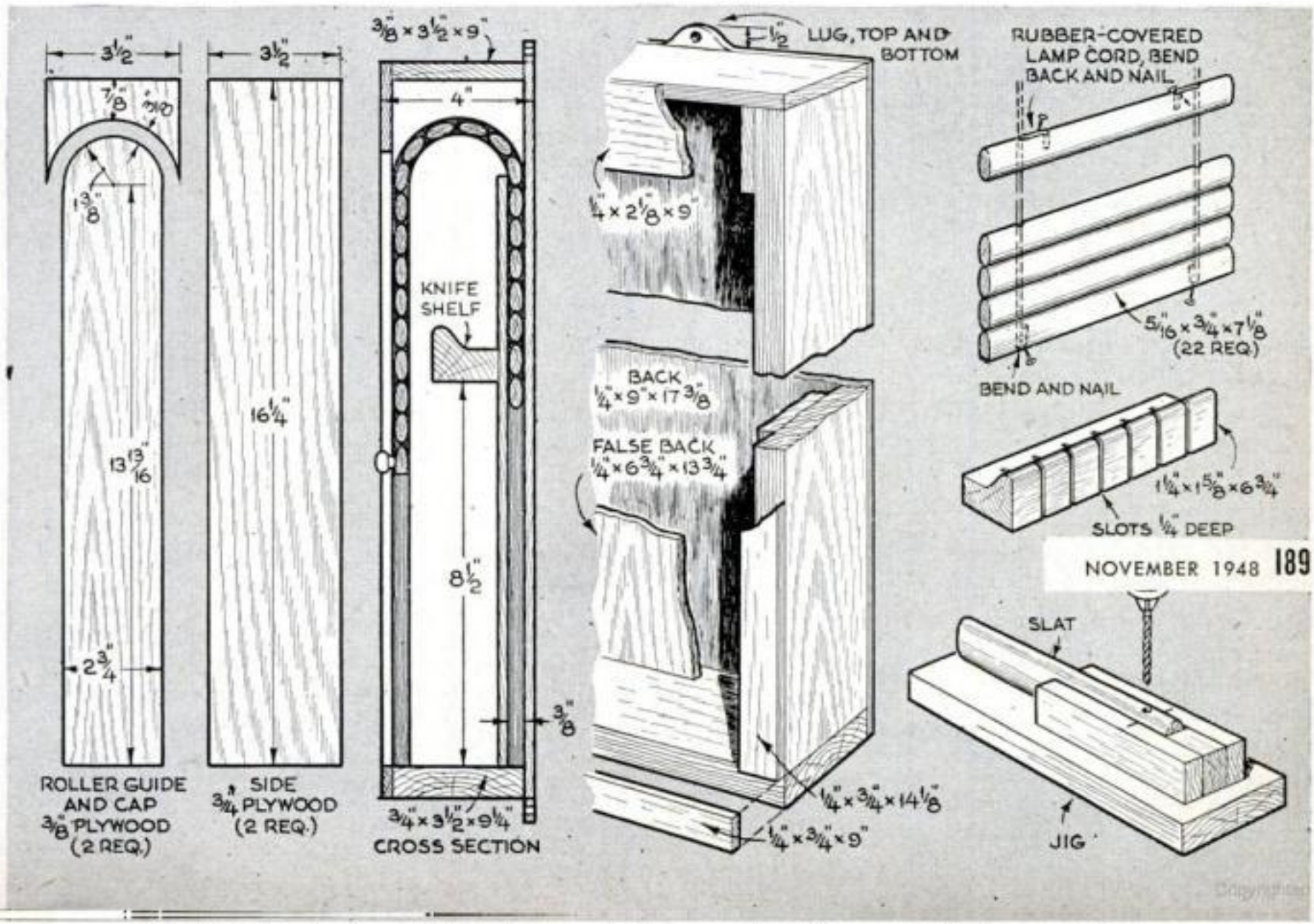
Now make the sliding door. Cut 22 pieces of pine 5/16" by ¾" by 7 ⅛". Sandpaper them smooth, rounding the edges so they will ride evenly over the guides. Build a jig, as shown in the drawing, and drill each piece. Then thread them on electric cord.

After nailing the knife bracket in place and screwing a knob to the door, give the inside of the case and the door two coats of white shellac. Then nail on the front framing.—*Dick Hutchinson, Alhambra, Calif.*

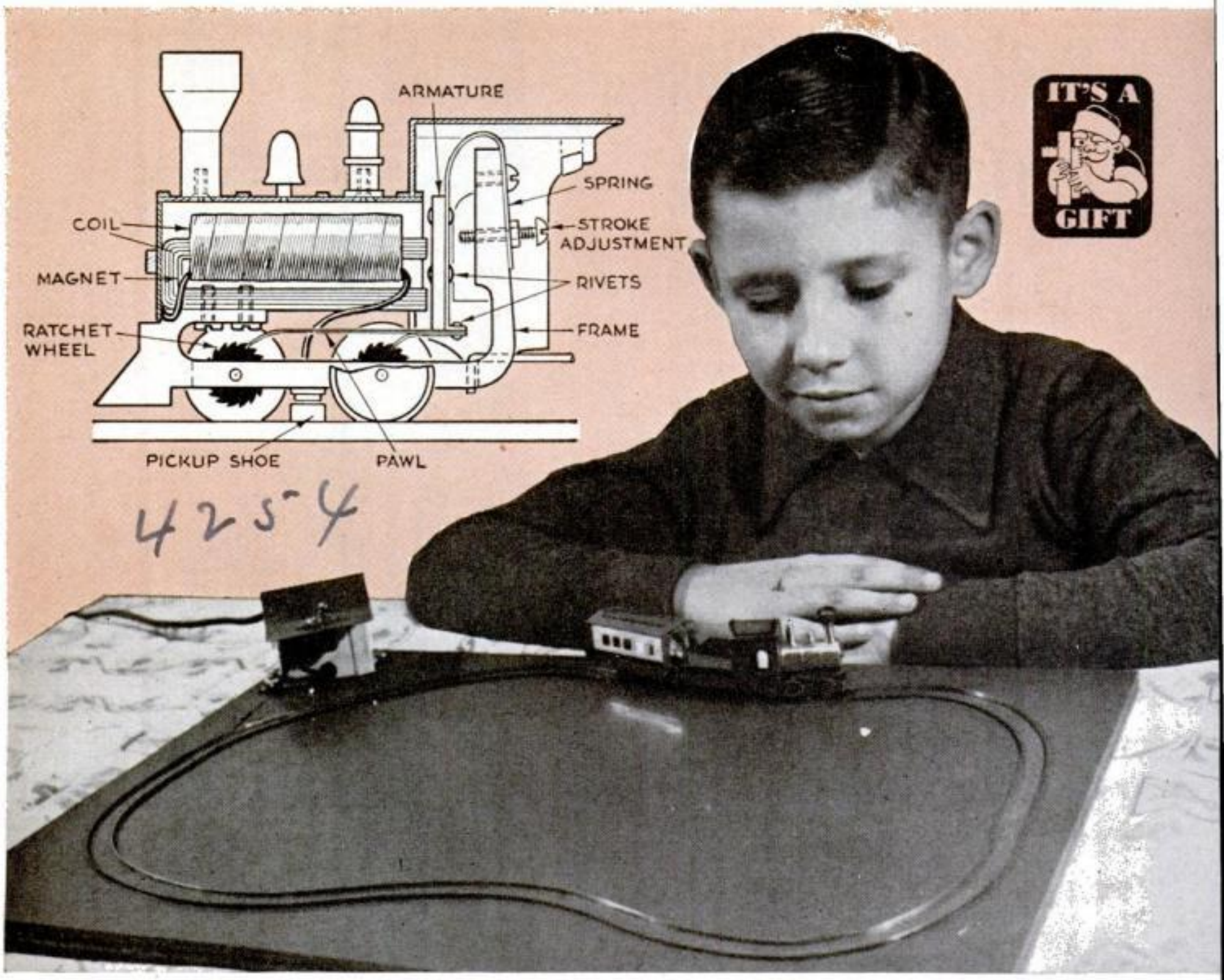




Test the sliding door before nailing the front and back pieces in place and before cutting off and fastening the cord. If some of the slats do not glide smoothly through the channels, slip them off the cord and give them an additional sanding. Sand the completed cabinet, above, and apply flat white paint and a coat of white enamel.



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Here the completed train chugs around its brass track. The inset is a full-size drawing.

Tiny Toy Train Has Electric Ratchet Drive

By Alfred J. Brosseau

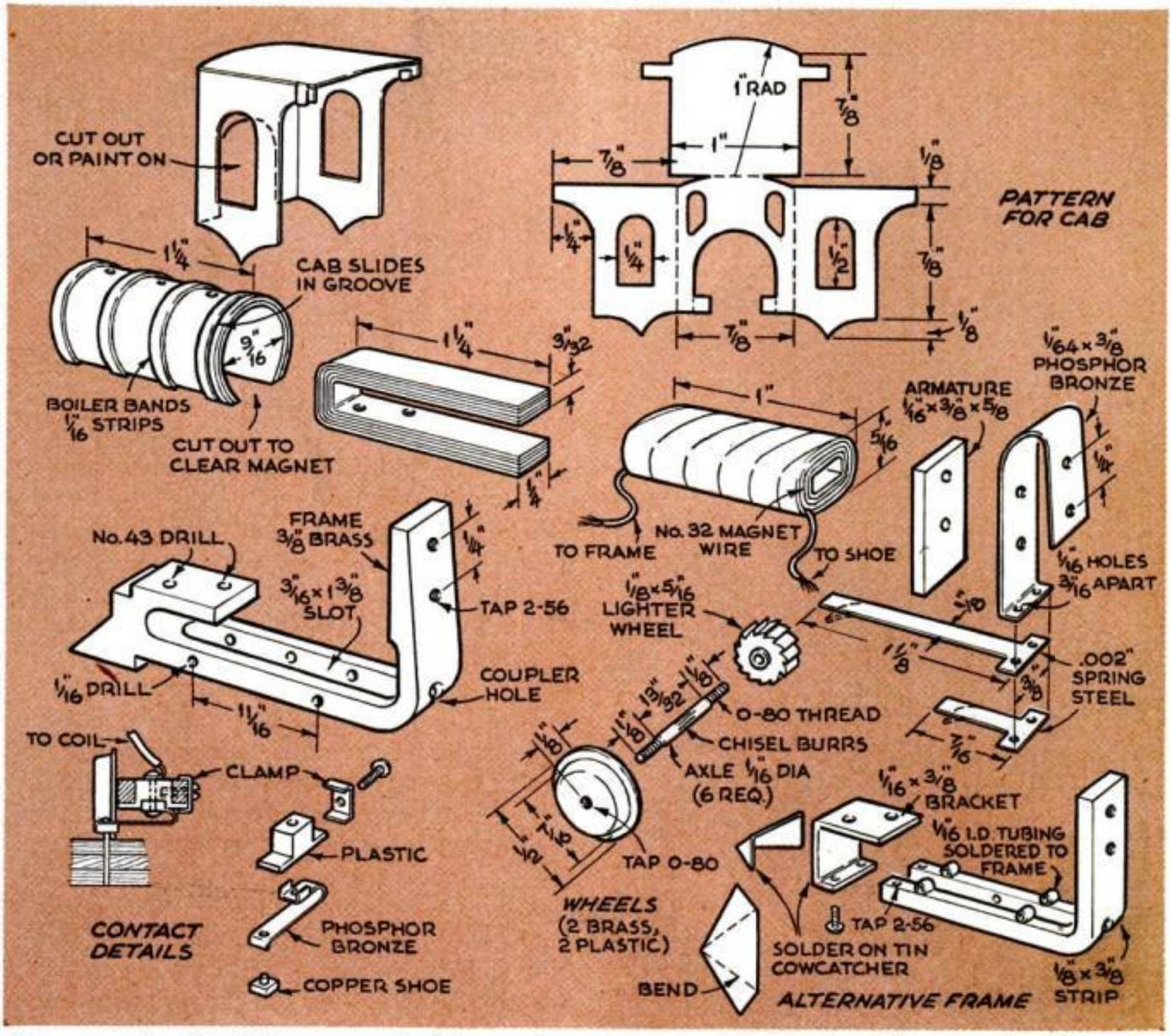
FOR the small-fry age that doesn't yet rate a scale-model train but wants "one that runs all by itself," here's a Casey Jones special Dad will have a lot of fun building.

Its drive is unusual. An AC magnet vibrates two pawls against ratchet wheels on the shafts, giving the wheels 120 kicks a second—enough to send the train scooting around the track. Painted in vivid colors, with the base for the track a bright green, the toy will be a happy surprise Christmas morning.

Although the locomotive parts are small, they don't require extreme precision. There are two ways to make the frame, as shown in the drawing on the opposite page. Use a piece of brass stock ⅜" wide. The slot in the one-piece frame can be made by drilling out most of the metal and removing the rest with a saw and file. On the right side of the frame, the center hole is for mounting the pick-up shoe.

Wind the coil on a ⅛" by ¼" arbor with No. 32 magnet wire and then bind it with adhesive tape. To make the magnet core, clamp seven pieces of soft iron in a vise and bend them to a right angle. Then clamp in a ⅛" piece of steel and bend the iron around it to form a U-shape. Use the frame as a jig to drill mounting holes in the core.

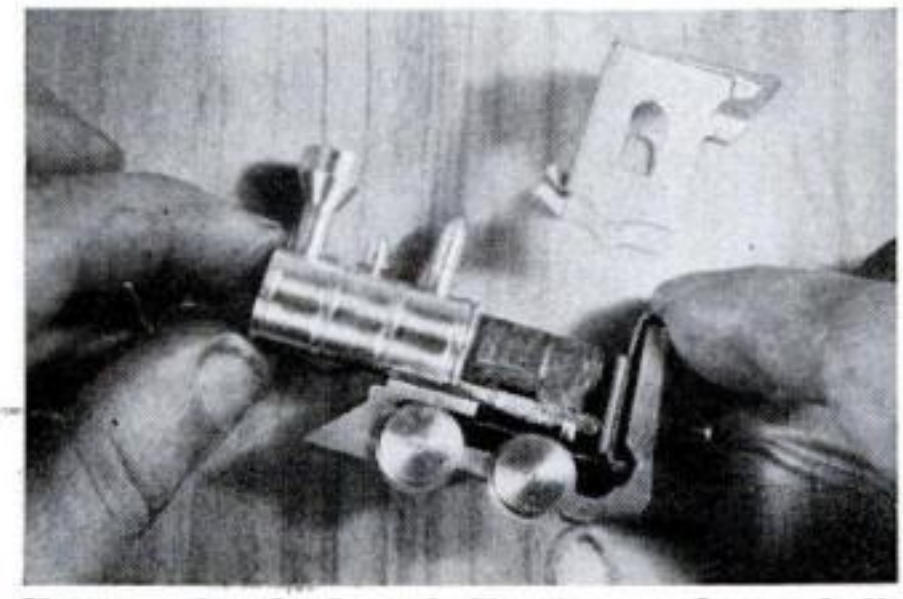
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Above are details of the magnetic-drive engine. Armature spring should be tuned to 60 cycles.

For the ratchet wheels, you can use cigarette-lighter wheels. Be sure to mount them with the hook of the teeth pointing rearward at the top, as shown. The contact shoe goes on the same side of the engine as the two plastic wheels. "Tune" the armature to 60-cycle frequency by filing it or weighting it with solder until it vibrates vigorously.

The boiler shell is a slotted aluminum or brass tube with bands of 1/16" metal cemented, soldered, or sprung on. The drawings include patterns for the cab, tender, and passenger car. You can sandwich sheet aluminum or tin plate between ¼" plywood,

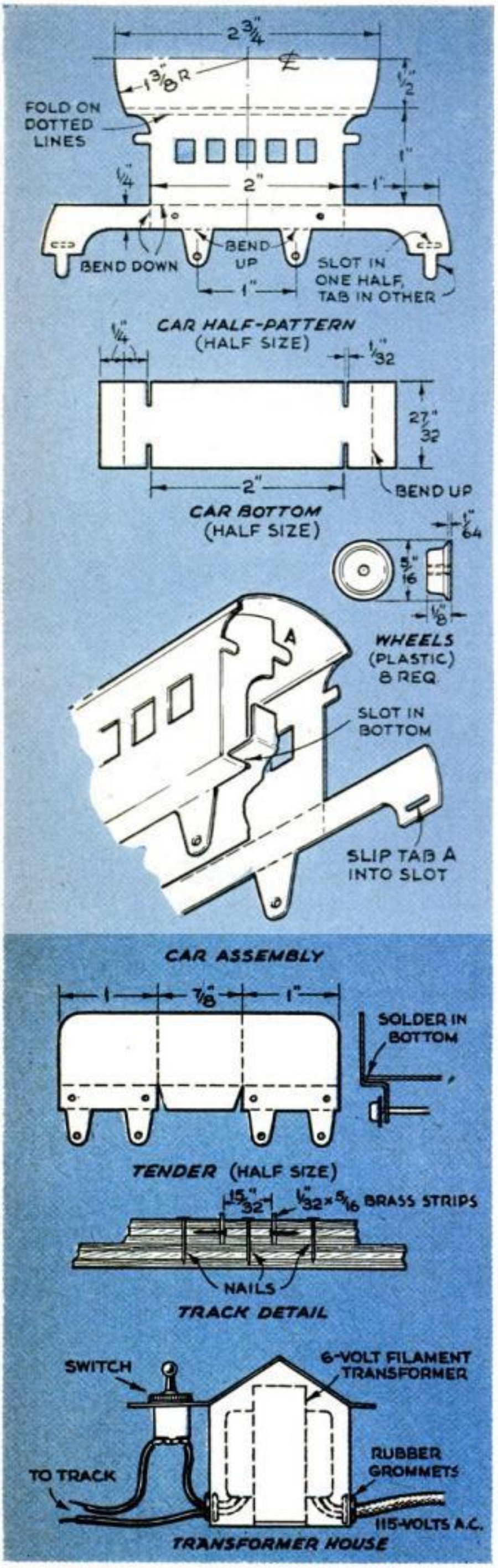


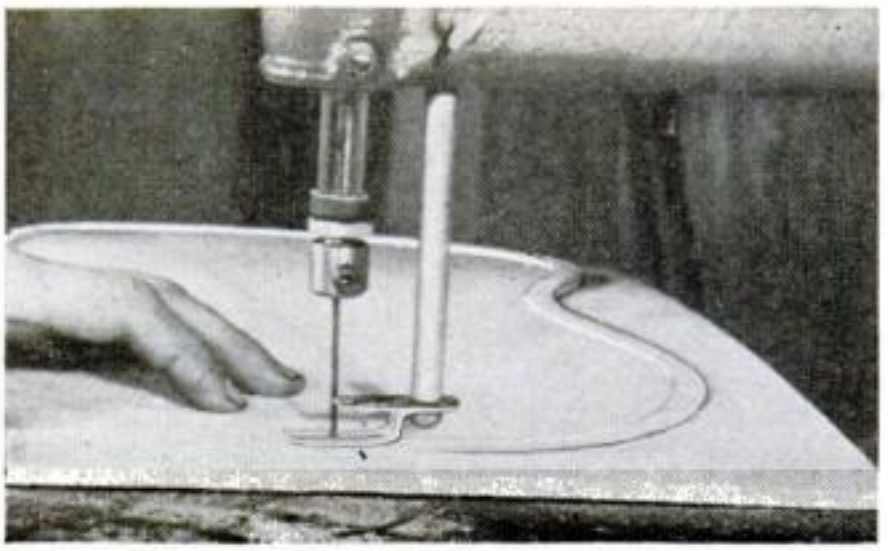
Fitting the boiler shell. Steam dome, bell, and smokestack are soldered on before assembly.



Putting on finishing touches. Paint the wheels, cab, and frame red. Then stripe with India ink.

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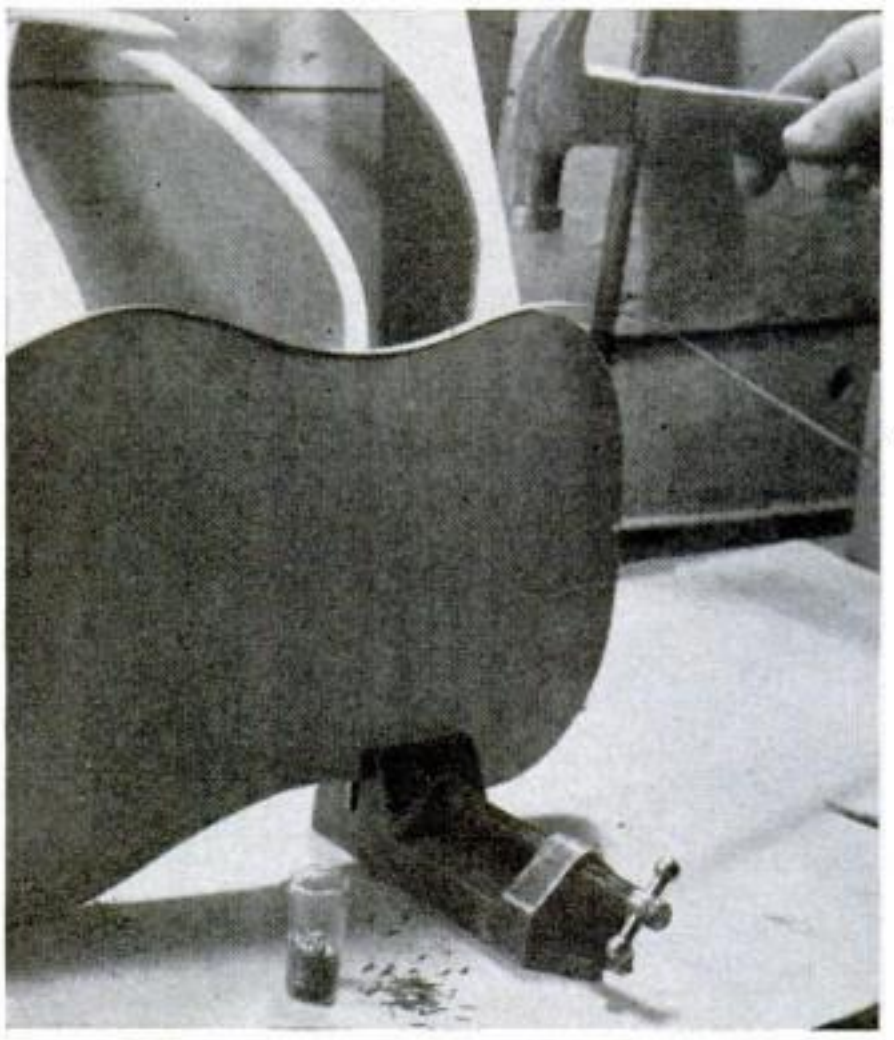


Cutting track layout. After first cut, carefully scribe a second line 15/32" in from the edge.

lay out the patterns on the wood, and cut them out on a jigsaw.

Make the track of two strips of brass, 1/32" thick and 5/16" wide. First lay out the line of the outside track and cut it out on the jig-saw. Then, on the inner piece of plywood, scribe a line 15/32" from the edge and cut along this, saving the narrow strip. Next drill very small holes in the bottom edges of the brass track strips and nail them to the two large pieces of plywood. Now take the narrow strip of plywood left by the jigsawing and put it back in place. Finally, nail all three pieces to a base.

After painting the engine and car, you can make decorative lines on them with India ink and a pen. Then connect a 6-volt transformer in the station to the track through a toggle switch, and highball. END

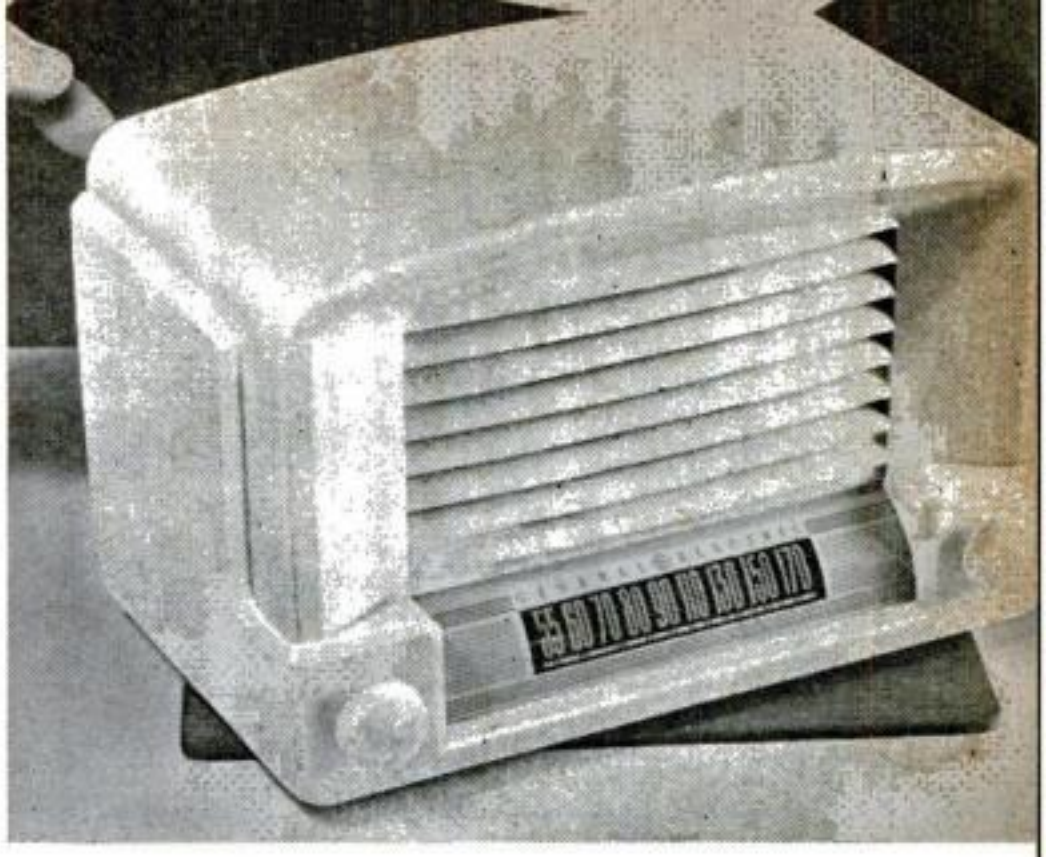


Assembling the track. Here the plywood is held in a vise for nailing brass strips to the edge.

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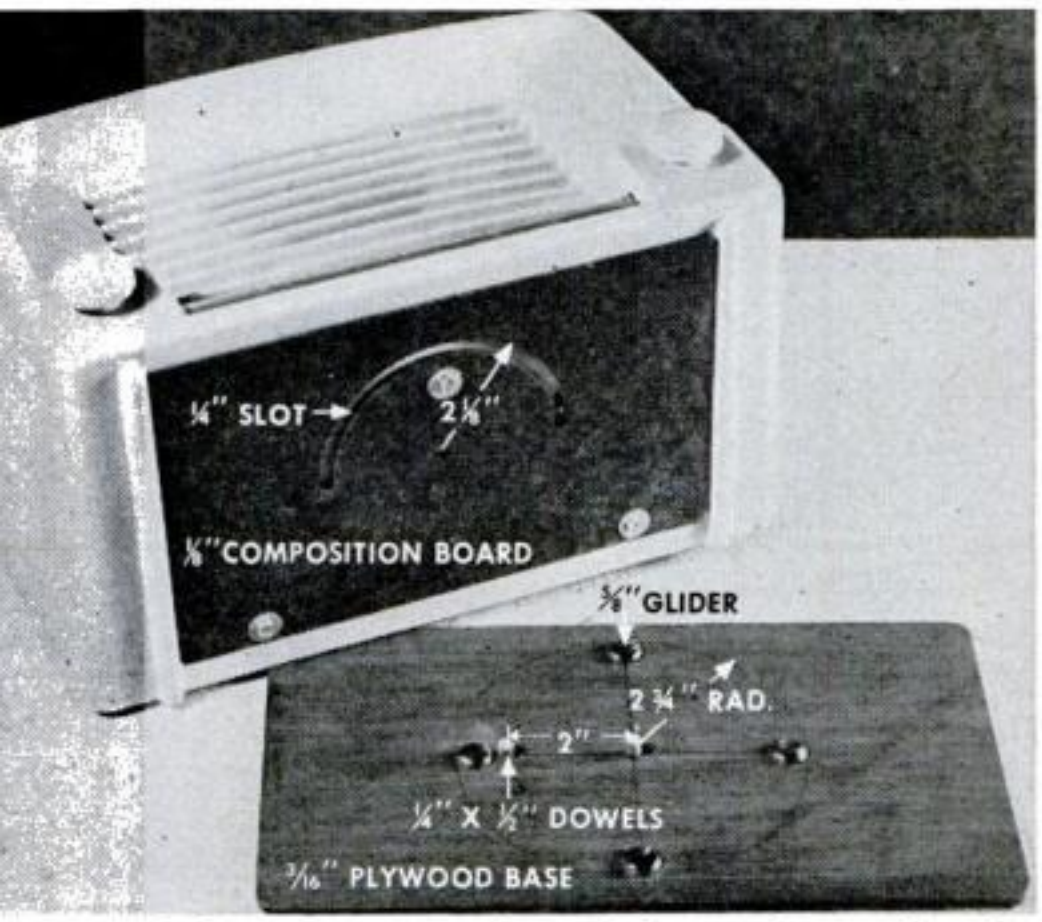
Turntable Swings Small Radio for Peaking Signal

$5 4 0 0



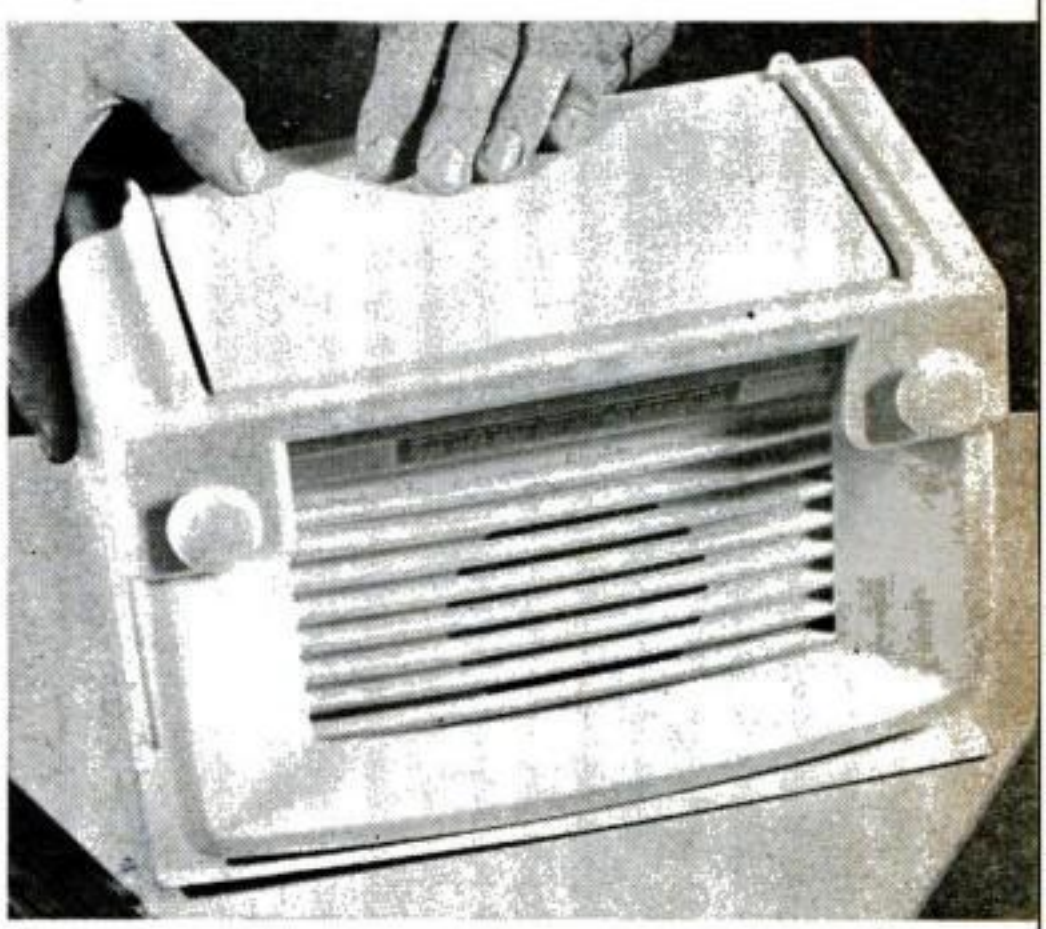
TWO real advantages are yours with this turntable for midget radios. Placed on it, the radio will swivel at the touch of a finger for tuning from either side of a table. If the set has a built-in loop antenna, another touch swings it to favor the station to which the dial is set. This can often make the difference between good and bad reception.

Dimensions may have to be changed slightly to suit the cabinet. A piece of ⅛" composition board cut to fit the bottom of the receiver is held in place by the chassis screws. Make a plywood base slightly smaller than the radio bottom. Space the pivot and stop pins and three furniture glides to suit. A bolt and nut may be substituted for the pivot pin, but take care that it does not come into contact with the chassis.– *Glenn A. Wagner, Delmar, N. Y.*



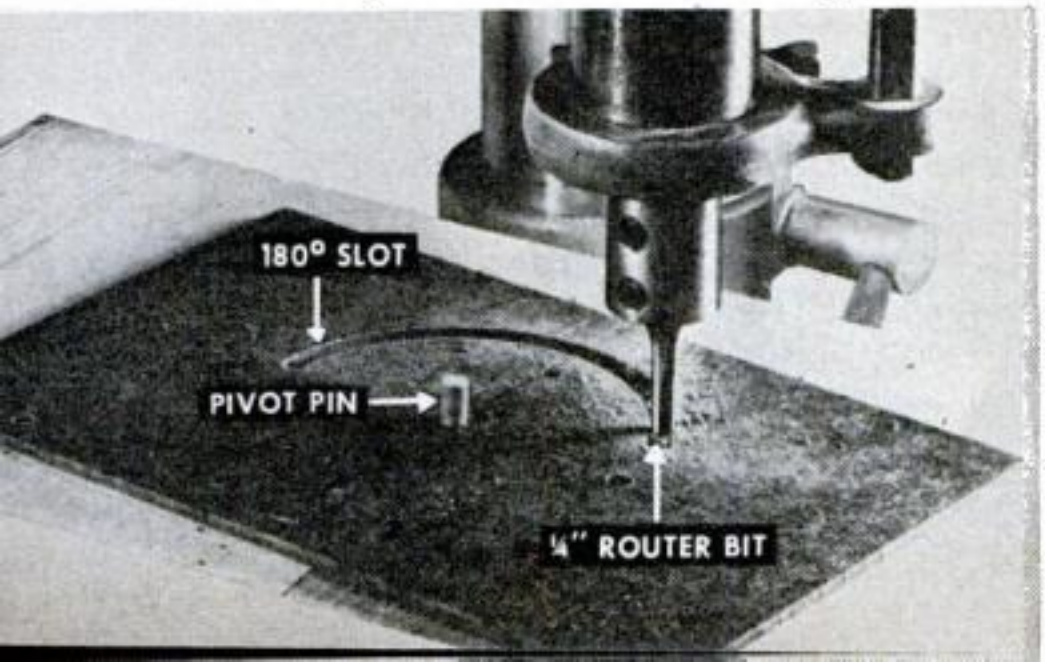
The composition-board plate is fastened to the receiver by the chassis screws. If desired, felt may be glued to the bottom of the base.

The arc slot for the stop pin can be scroll-sawed, or routed as above. A dowel is set in a board clamped beneath to act as a pivot.



To locate the screw centers, cut a piece of paper the size of the plate, press it down, and transfer the imprinted marks for drilling.

Sand and finish the base before hammering in the ⅜" furniture glides. The ¼" by ½" dowel pins should be glued into holes in the base.





Model Air Engine Runs on Any Fuel



Fired up with anything from wood shavings to a Bunsen burner, the engine does a steady 400 r.p.m. It has no boiler or safety valve. Power piston delivers two impulses every revolution.

6216

Tin snips and soldering iron are your chief tools for building this model of a 19th Century power plant.

By Harry Walton

PERHAPS the rebirth of the hot-air engine (see PS, Feb. '48, p. 145) gave you a yen to see this old-timer in action. Although the improved Philips design would require careful machining, you can easily make a model of the old two-cylinder type.

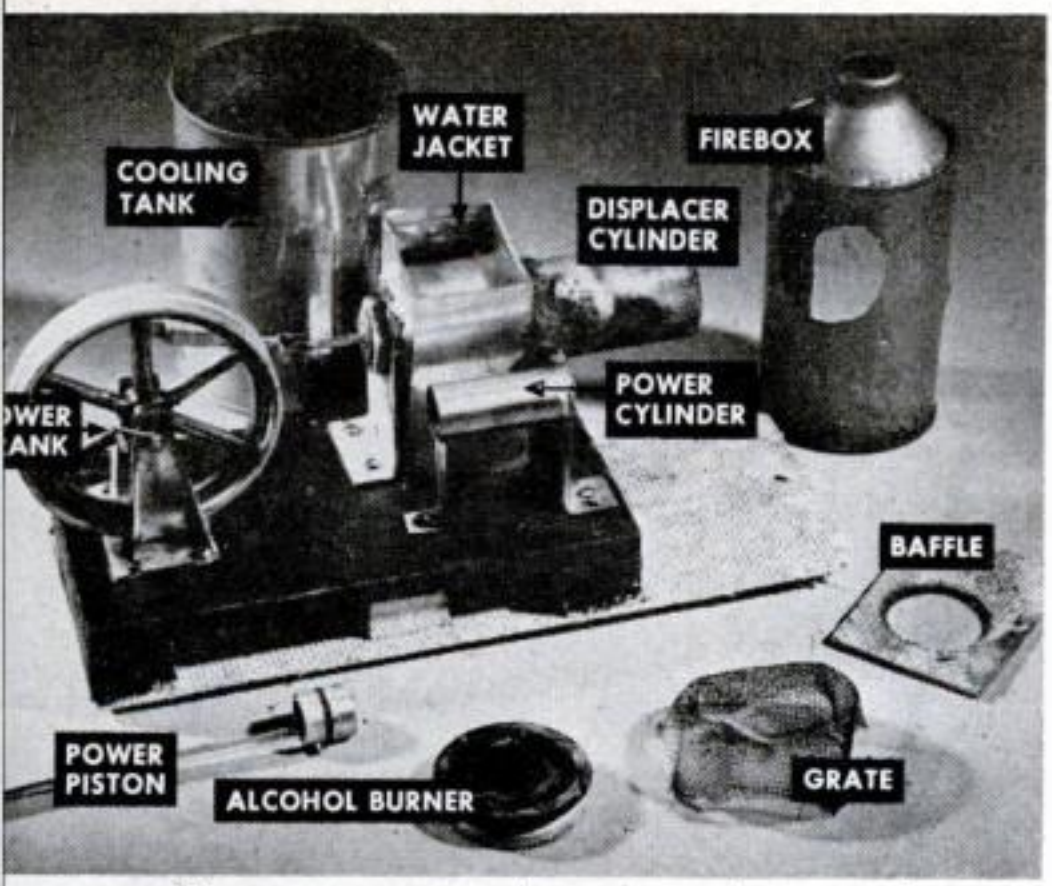
The little engine shown demonstrates some of the advantages of this prime mover —quietness, full-stroke double action, and an entire lack of choosiness about fuel. It has run on alcohol, fire kindlers, gas, wood shavings, and even matchsticks!

Designed for easy construction, the model has no critical dimensions. Those shown may be altered so long as similar cylinder proportions are maintained and cranks give proper piston action.

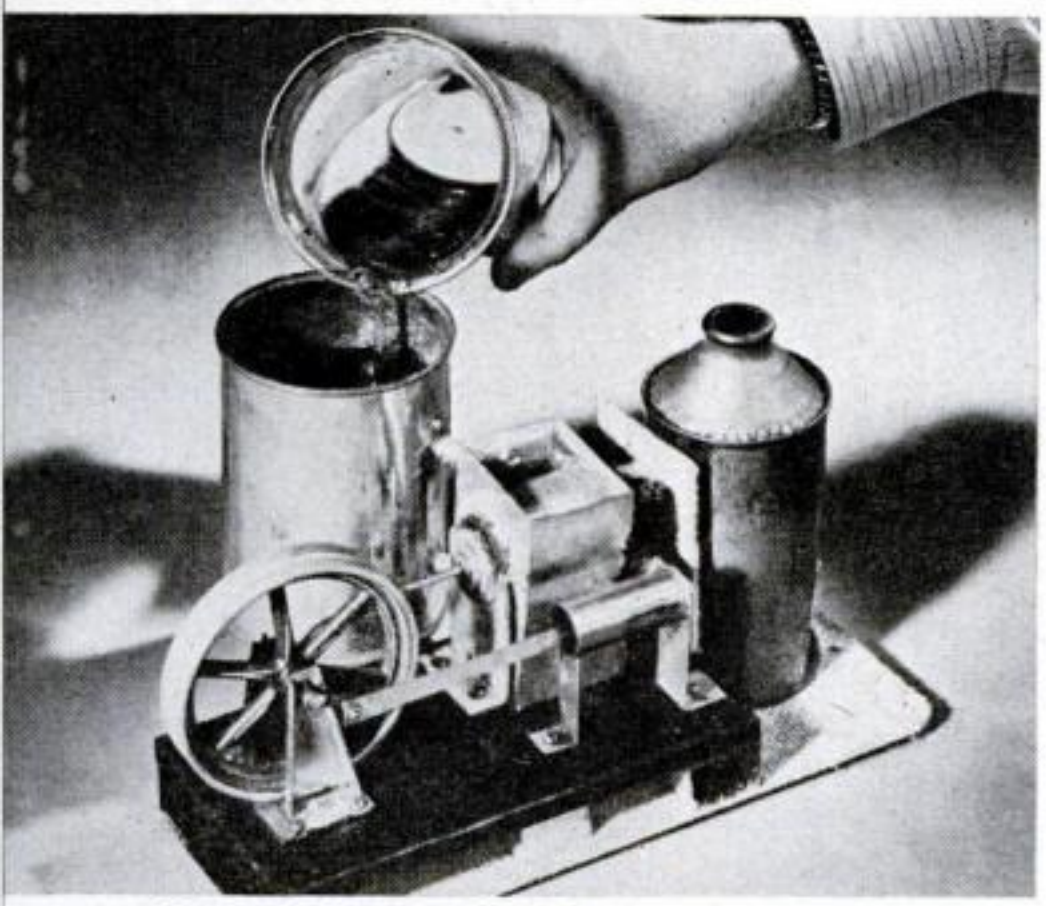
An old electrolytic radio condenser with a seamless drawn can and a mounting nut forms the displacer cylinder. Remove the nut, pry out the closing disk, and empty the contents. Drill or punch a hole to fit the port tube midway of the cylinder.

A small condenser can, film container,

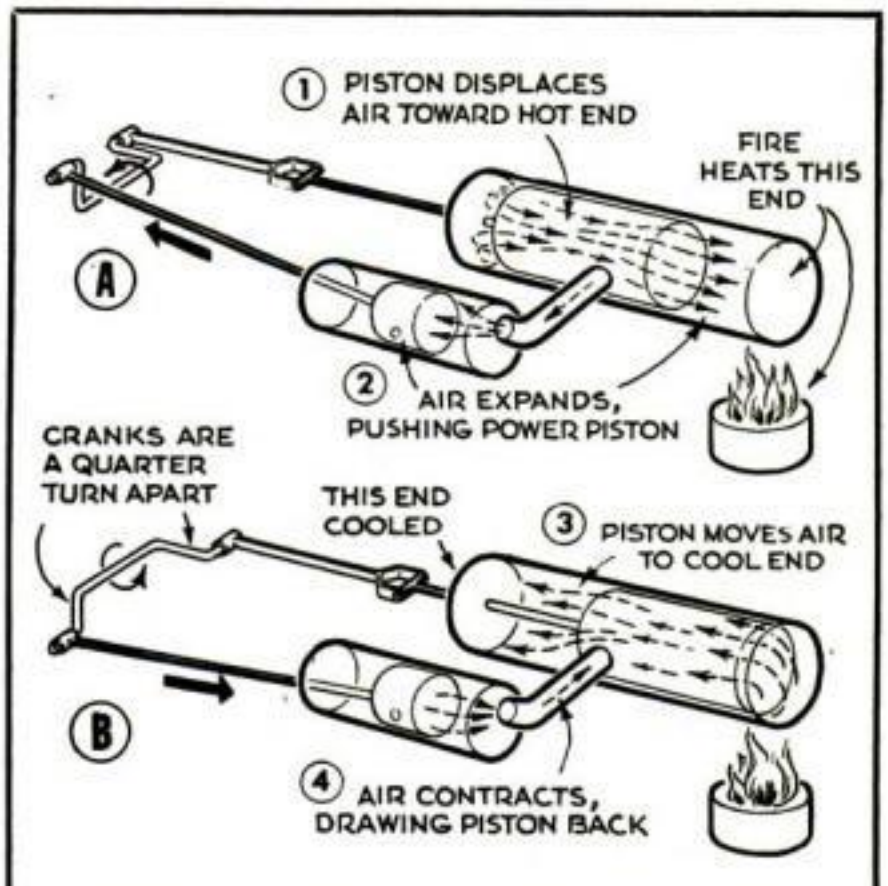
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Fly-screen grate burns matches or charcoal. Baffle slips on displacer just ahead of firebox.



Heat differential is key to power. Extra tin-can tank keeps water in jacket from boiling.



What Makes It Run?

LIKE most things, air expands when heated. In the air engine, it's alternately heated and cooled. Changing volume, it can be made to push a piston back and forth.

At A, a loose-fitting displacer piston in a closed cylinder is at the cool end, forcing most of the enclosed air to go to the hot end. Heated, it expands, and through the connecting port pushes the power piston in the small cylinder forward.

As both cranks are on the same shaft, this moves the displacer piston back as at B. Air is forced to flow past it to the cool end. Here the air contracts, sucking the small piston back. Thus there are two power strokes. A water jacket or fins keep one end of the displacer cylinder cool.

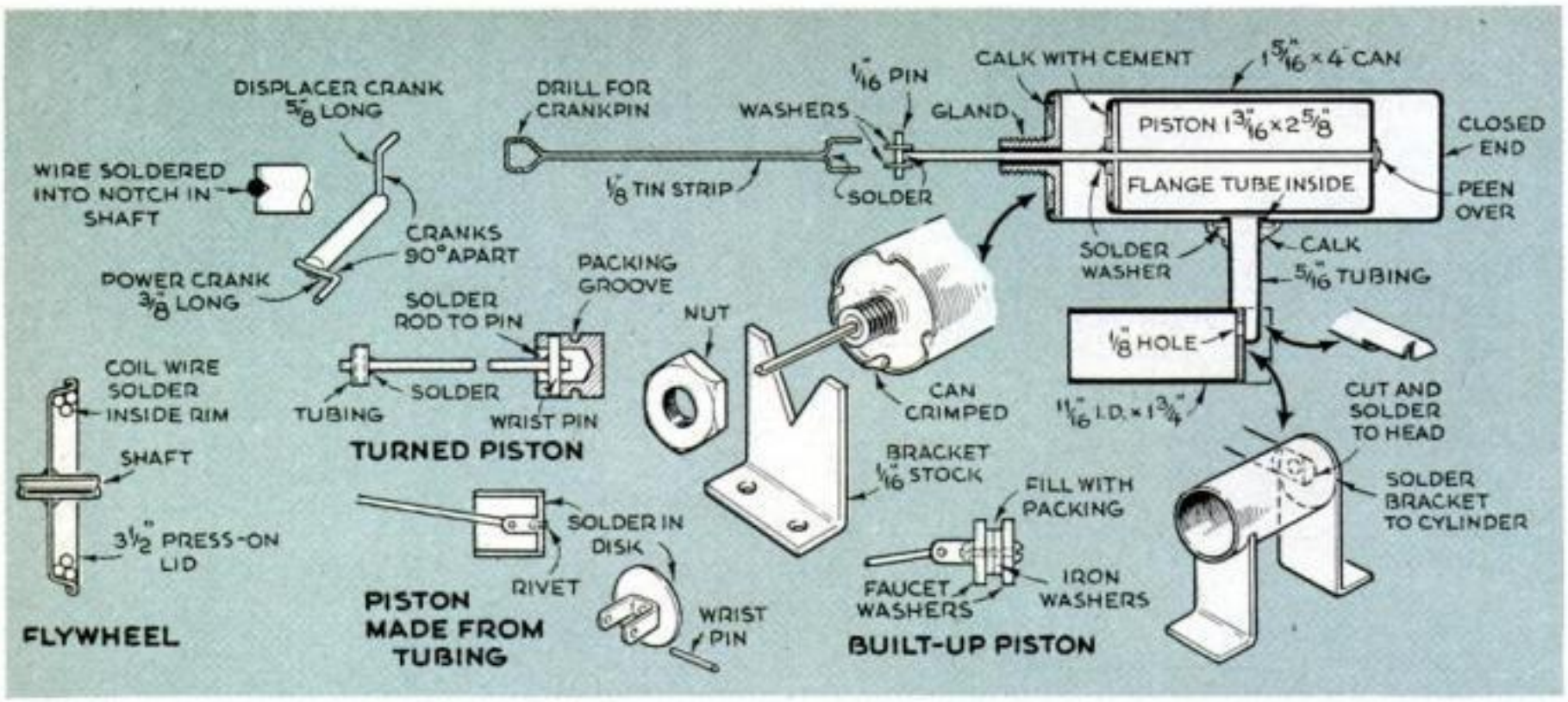
or bouillon-cube can that will fit into the displacer cylinder *loosely*—leaving a gap of about 1/16″ all around—becomes the displacer piston. It must be light and fitted with a lid so that you can close both ends. Run the piston rod right through, peening over the end. To keep the piston from sliding on the rod, solder a washer at the front end or hammer a flat crimp on the rod.

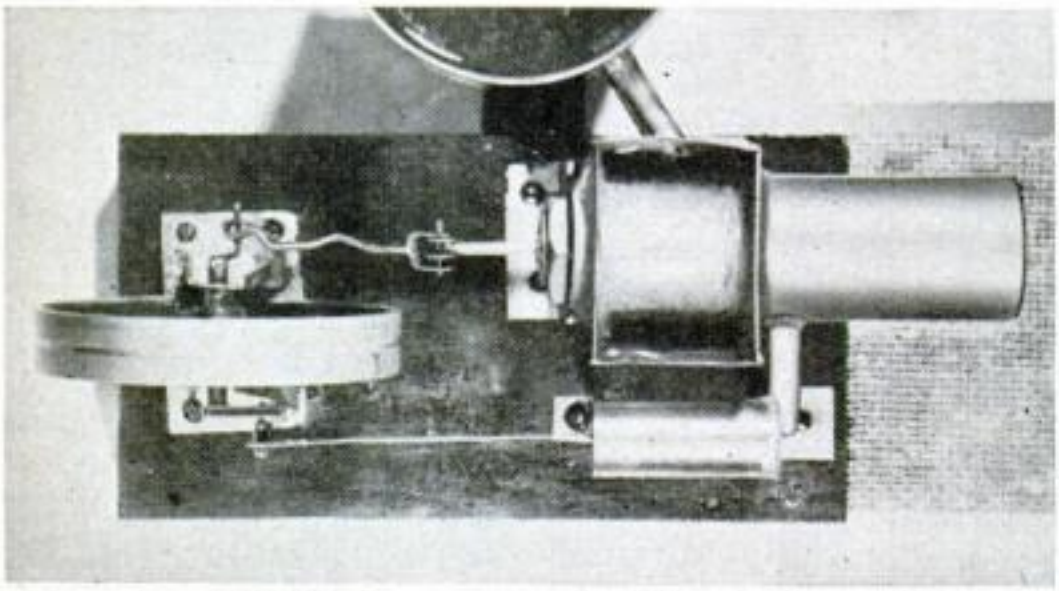
You'll have to bush the hole in the end disk through which the condenser wires passed. Drive in a brass or lead plug and drill it a close sliding fit for the piston rod. It's a good dodge to drill undersize, and then file a long flat bevel from one end on a piece of the piston-rod material, for use as a reamer. The rod must slide freely without spilling air, and the gland should be long enough to carry the load of the piston without binding.

File the port tube to fit the power cylinder as in the drawing, bending down the end to close it. Then flange over the other end slightly so that it won't slip out of the displacer cylinder after it's inserted from inside. Solder on a washer to keep it from slipping back in.

Calk any holes in the displacer piston with auto body solder, black furnace cement, or similar metallic putty. The piston must

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Plan view with firebox removed. Flywheel goes between bearings. Water jacket surrounds 1½" of big cylinder.

be airtight and securely fixed on its rod.

The water jacket is a tin-plate box. Make two cylinder-size holes in each end of a strip and bend it U-shaped. Slip it on the cylinder and solder on two side plates. The joints between tank and cylinder can be calked later.

With the piston inside, crimp over the can to hold the end disk in. Calk all around, and mount on a notched bracket, drawing up the condenser nut to clamp the crimped end tightly. The piston should slide freely the full length of the cylinder.

A piece of seamless brass tube makes a good power cylinder. The back tin-plate bracket also forms the cylinder head. Put a ⅛" hole in it, solder the bracket in place, and solder the port tube over the hole. Be sure all is airtight. Then mount the two cylinders on a base and calk around the port tube and water jacket. For continuous running, connect a tin-can cooling tank with two tubes to the top and bottom of the jacket.

A bit of aluminum was turned to make the power piston, with one packing groove. This can be done on a wood lathe, a drill press, or in an electric drill. If you can find a piece of tubing that slides closely in the cylinder (or can be made to do so with emery cloth) you can solder on a piston head to which is riveted a wrist-pin bearing. You can also build up a piston from washers, turned to diameter in a drill chuck by applying a file.

Bearing standards and connecting rods are tin plate. A flywheel can be improvised from a can lid as shown. Space the cranks 90 deg. apart and bend the rods to get piston strokes right. With only the displacer connected, the flywheel should spin easily. The power piston, fitted with faucet packing and oiled, should have a compression bounce.

Cut a hole in a bit of asbestos board and slip it on the hot end of the big cylinder as a heat baffle. Make a firebox from a flare-top beer can. Roll up a strip of soft sheet asbestos in a jar lid for an alcohol burner, or make a grate out of some screening for solid fuel.

Fill the cooling tank, light up, and in less than a minute the engine should respond to a starting twist by running merrily. If it doesn't, look for air leaks at the calked joints, a leaky piston-rod gland, or mechanical binding. To check leaks, remove the power piston and insert a cork with a hole in which a bicycle-pump tube is fitted. Put the engine under water and pump.

You can demonstrate the action by holding the power-piston rod in the fingers and sliding the displacer rod back and forth. The power piston should follow it. END

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Decorate the finished project with brass nail heads and buy a 3⅜" square glass ash tray at a dime store. At right, an endpiece has been removed for a view of the interior construction.

Leather-Covered Smoking Set

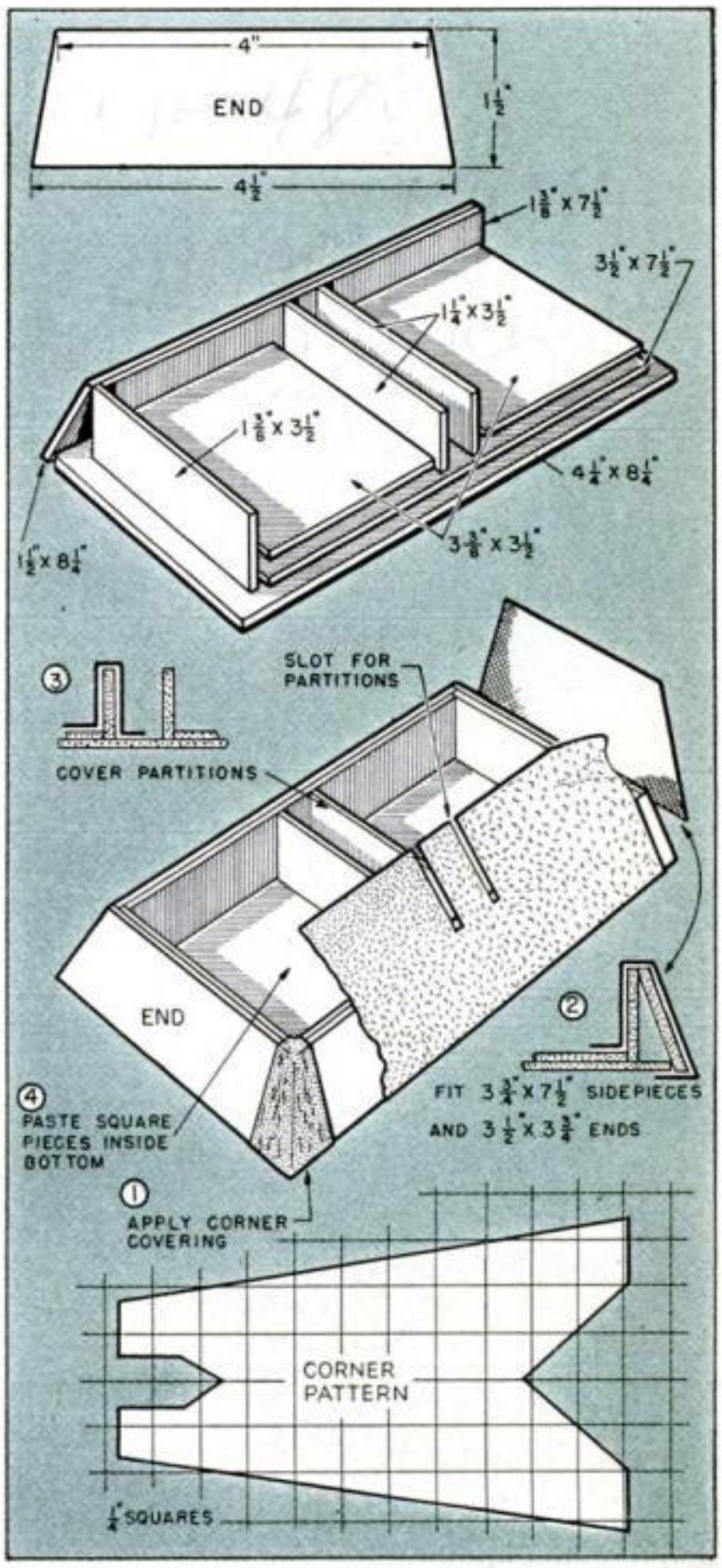
CARDBOARD, artificial leather, and glue are the main materials needed for this combination ash tray, cigarette box, and match holder. Tools used are a knife and scissors.

Make the box first, cutting out the pieces and gluing them together. After the box is assembled, glue it to the 4¼" by 8¼" base, and then attach the slanting sides and ends. As you go along with the construction, glue 1" wide strips of wrapping paper along each joint to strengthen the form.

The set will look nicer if you finish it in two shades of artificial leather. About ¼ yd. of each color will make two complete sets. Use one color for the corners and bottoms and the other color for sides, partitions, and cover. The cover is a 3⅜" square of cardboard fitted with a pull ring. Glue on the leather before screwing the pull ring in place.

Corner pieces can be cut by the pattern. Glue these on first, fitting them so the wide end will overlap the bottom of the form and the narrow end will overlap inside the form. Cut the side coverings 3¾" by 7½", overlapping ¼" on the bottom. Don't forget to cut narrow slits in the sidepieces to fit the partitions. The endpieces are glued on the same way, so they overlap the bottom. Cut two 3¼" squares and glue them to the bottom of each section. Lastly, cut a 4¼" by 8¼" piece for the outside of the bottom.

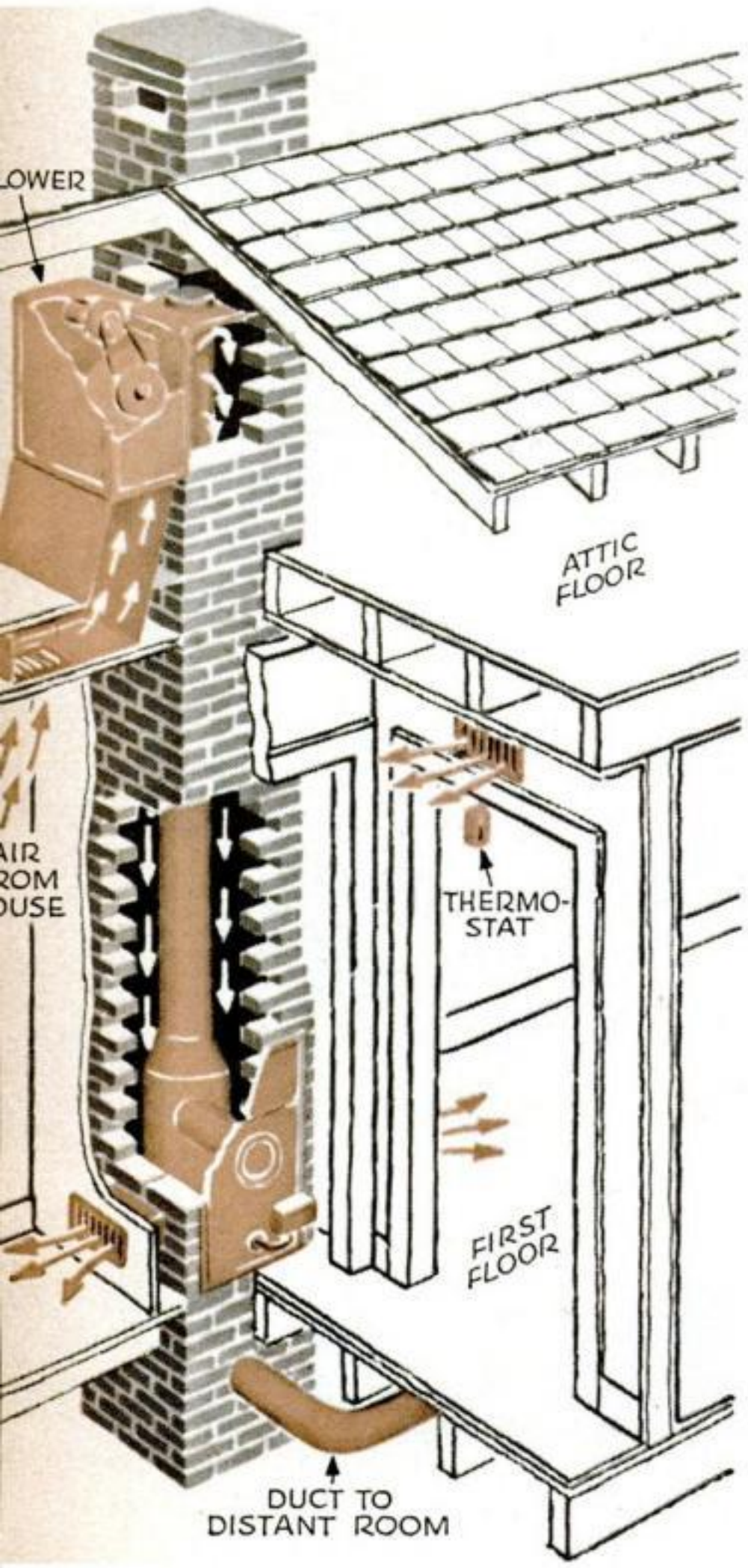
The lid rests on a thin cedarwood lining glued in the cigarette container.—*David Wishner and Jay Obrien, Brooklyn, N. Y.*



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New Furnaces Lick Fuel Shortages



Hidden inside chimney, this novel oil furnace is designed to save space in new homes. Attic fan forces air down along a heated steel pipe in chimney and out through registers at floor level. Under-floor ducts carry heat to distant rooms. The chimney must be specially built.

WITH fuel scarce in recent years, you'd have given a big welcome to some of the new home heaters now on the market. Not only do they get more heat from the fuel you burn, but if one fuel becomes short or too expensive, you quickly convert to another that's in better supply or less costly.

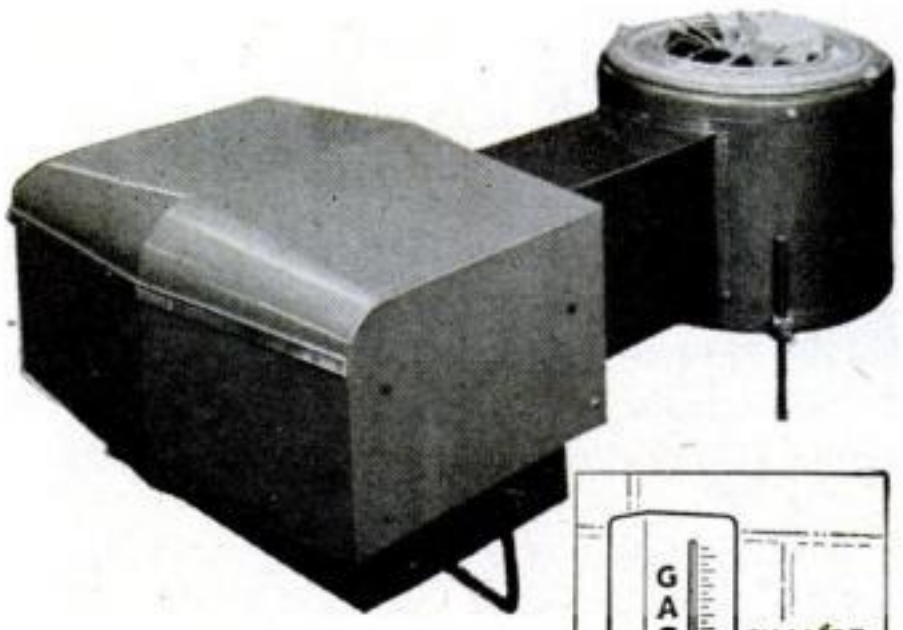
In one case, you just flip a switch. Push it one way and you start up the oil burner. Push it the other, and you're all set to burn coal.

You'll find this convenience in a double-duty heater now being produced by the Diesel Oil Burner Corporation, of Jamaica, N. Y. This unit has two separate combustion chambers housed in a single compact jacket, one for coal, one for oil. The heater is suitable either for steam or hot water.

Chrysler Airtemp, Norge, and Spencer are other manufacturers who have heeded the lesson of the war years, when many home owners had difficulty changing over their plants to another fuel.

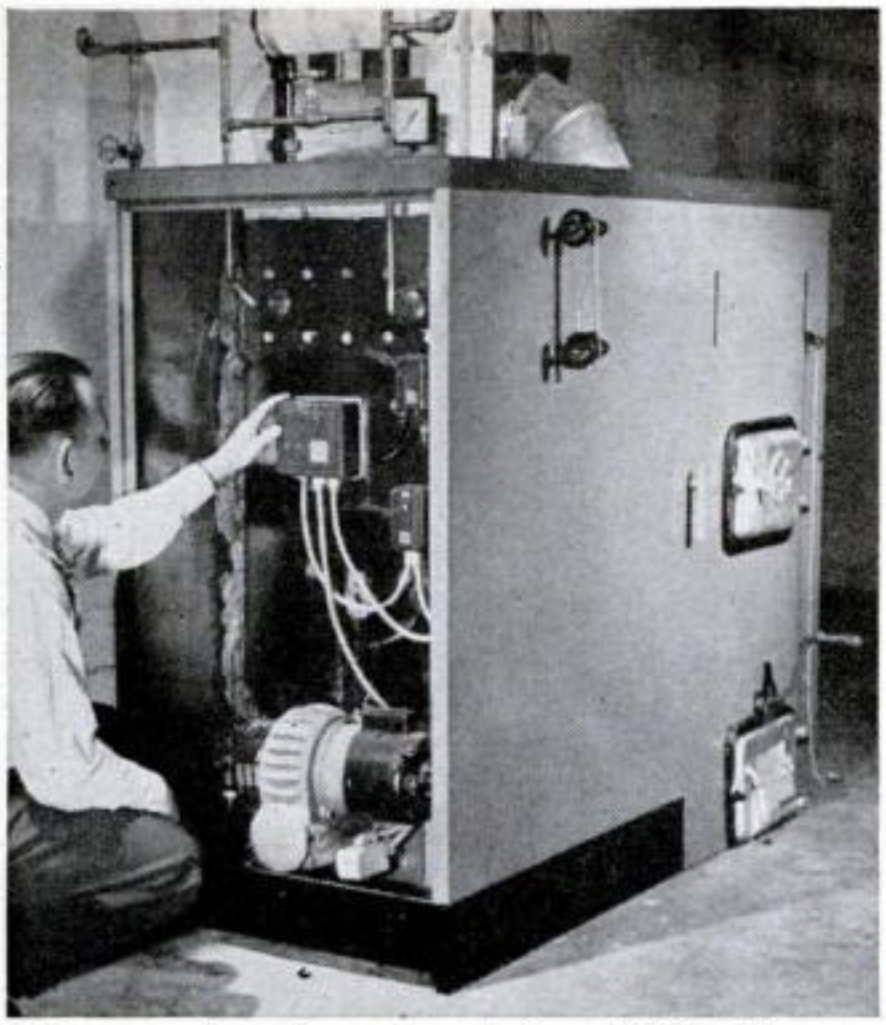
With any of these makes, a hand-fired coal furnace is now the basic unit. Starting with this, you can later make it automatic by adding a coal stoker, an oil burner, or a gas burner. When the change is to oil or gas, the coal grates are removed and stored away for emergency use.

A novel gas-oil conversion unit has been

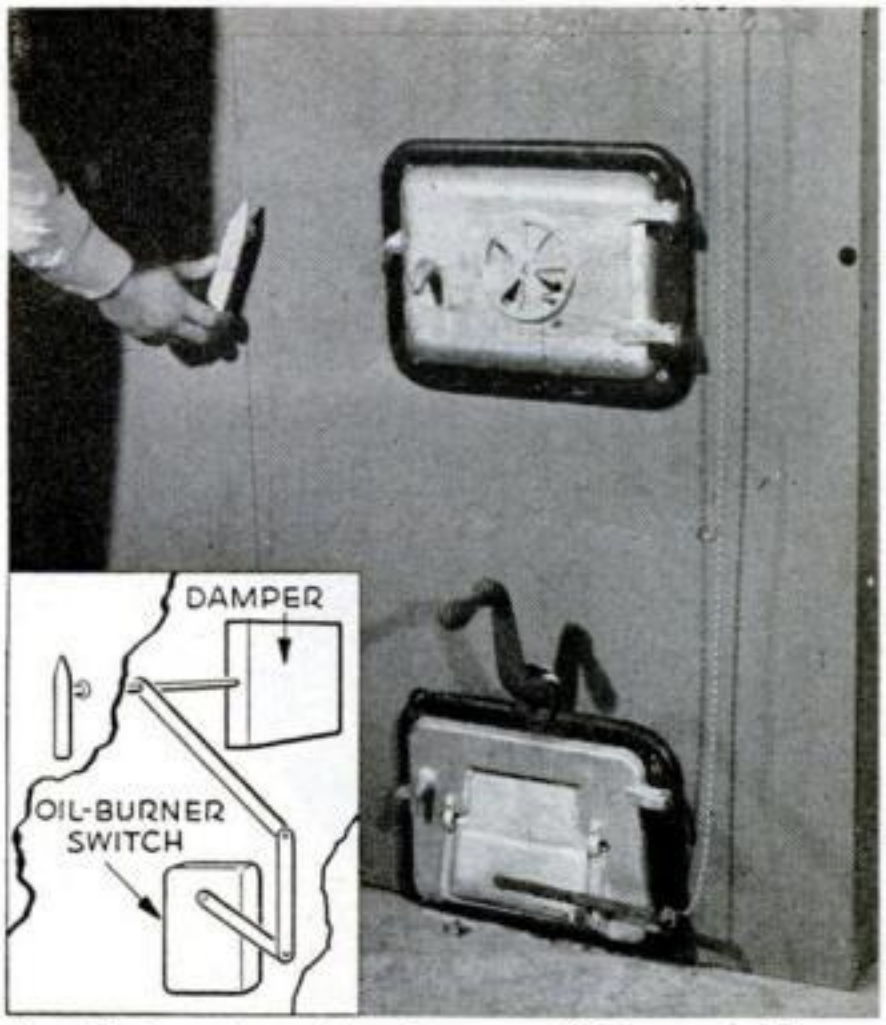


A thermostat outside house switches this heating unit back and forth between oil and gas. Oil is used only if temperature drop puts heavy load on local gas supply.

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Oil or coal, take your choice. With this new heater, made by Diesel Oil Burner Corp., you change from one fuel to the other in a matter of minutes. Note coal-feed door on the side.



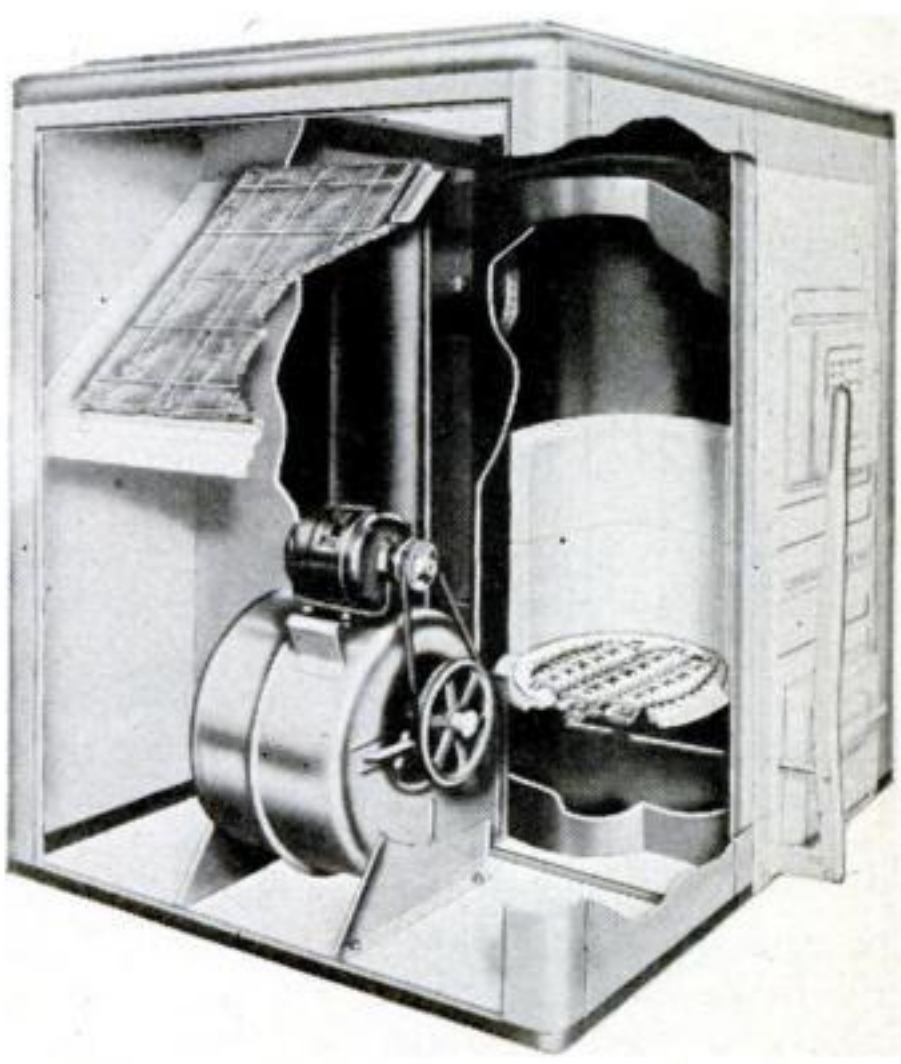
A switch makes the change. This manual lever prevents use of oil and coal equipment at the same time. When the coal damper is opened, a switch automatically cuts off oil burner.

introduced by Norman Products Company, of Columbus, Ohio. This unit automatically switches back and forth between oil and gas, depending on the temperature outside your home.

Ordinarily, it burns gas. But when the temperature drops to a predetermined point, a thermostat mounted outside the house shuts off the gas and feeds oil instead. The changeover point is slightly above the

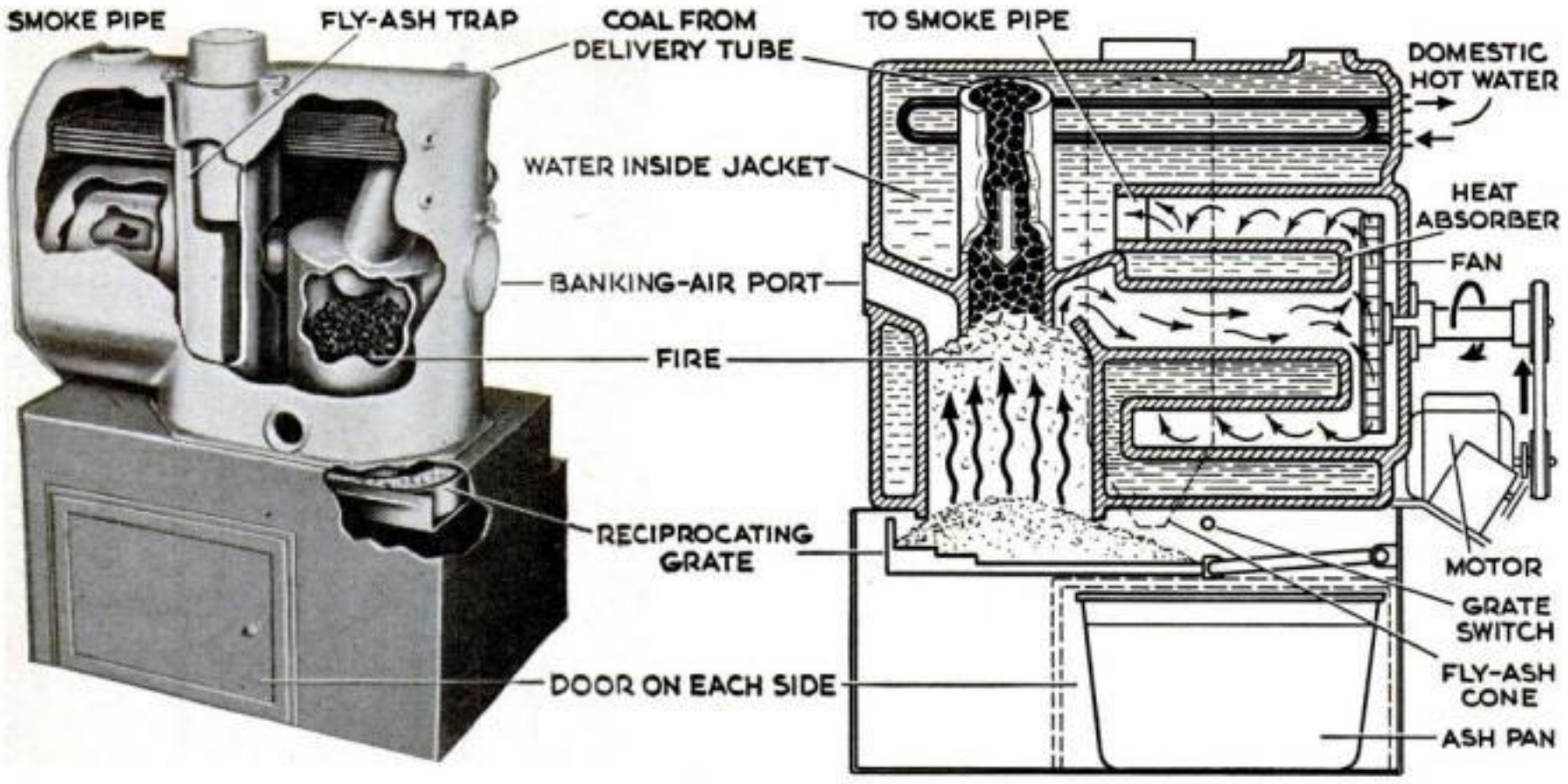


Grates are easily removed from the Chrysler Airtemp ® if you want to shift from coal to oil. Sheet metal is placed around oil burner to close furnace. Ash door is stored away.



A blower and air filter are seen in cut-away view of Chrysler Airtemp. An optional feature, the blower-filter unit increases the heating efficiency of this hot-air furnace.

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You can now buy the Anthratube. Commercial unit above is made by Axeman-Anderson Co., Williamsport, Pa. Developed by the hard-coal trade association (PS, Dec. '46, p. 152), the Anthratube burns anthracite by forced draft. A revolving screw (not shown) feeds the coal.

temperature where the gas company's peak load occurs—the time when everyone is using gas and there may not be enough to go around. When the cold snap is over, the unit switches back to gas.

Gun-type oil burners are being made more efficient, particularly in respect to their ability to burn the new catalytic oils that you now sometimes get instead of the thermally cracked oil of former years. This is important to you since the catalytic stock is usually more economical to buy.

The trend here is toward greater turbulence in the air that's mixed with the oil. Among the leaders in this respect are Norge and the Richfield Manufacturing Co., of Baldwin, N. Y. Norge is marketing a Whirlator Head ® and Richfield a Turbulator Head ®. Both of these are said to break up the oil into finer particles.

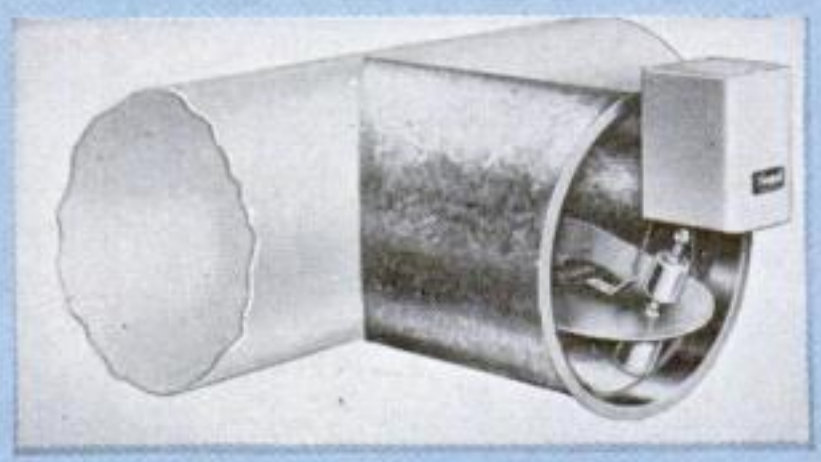
Space saving is an aim of some manufacturers, and new heaters in general are more compact than a few years ago. Unique in the space-saving field is a warm-air oil furnace that's hidden in a 25″ by 25″ chimney. Made by Chimney Furnace Corporation, Rockville, Md., it utilizes the heat that often escapes up the chimney. An accompanying sketch shows its operation. A fan drives air down along a heated pipe.

This furnace can be used in either a basement or no-basement home, but it's limited to new construction because a special chimney is required. The chimney must be inside the house to prevent heat loss. END

New Heating Accessories Stretch Your Fuel Dollars

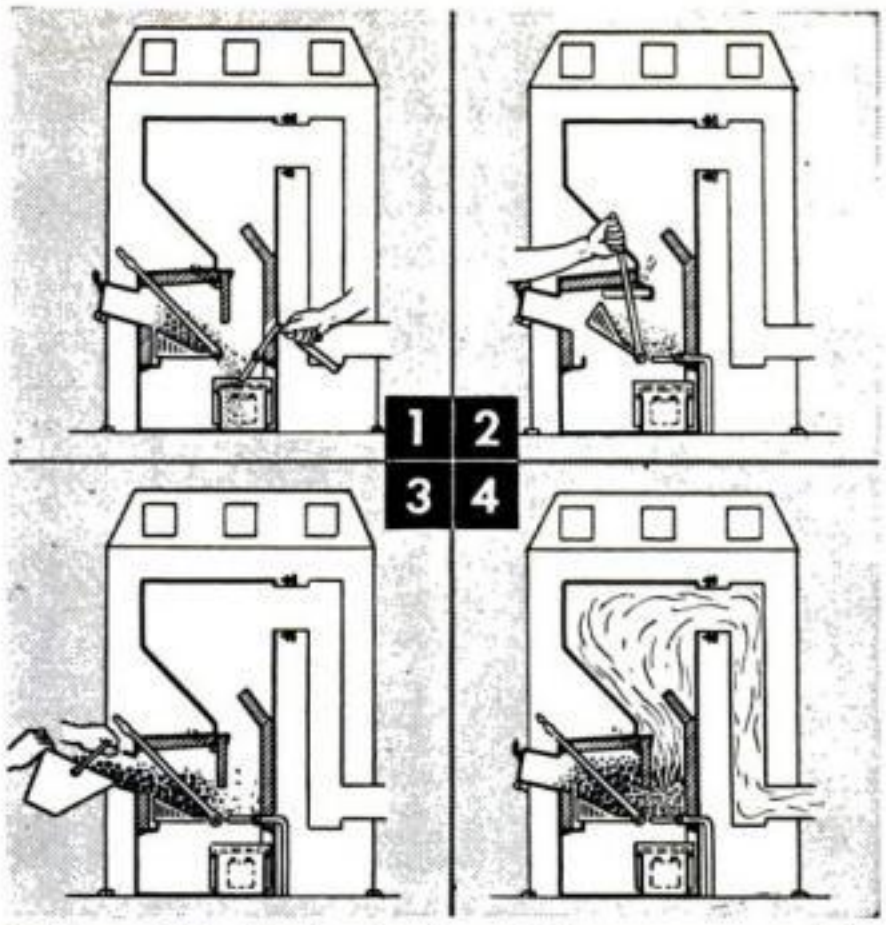


Thermo-Matic Registers ® made by Dole Valve Co., Chicago, regulate heat input to each room. An easily-set thermostat keeps the room at desired temperature.

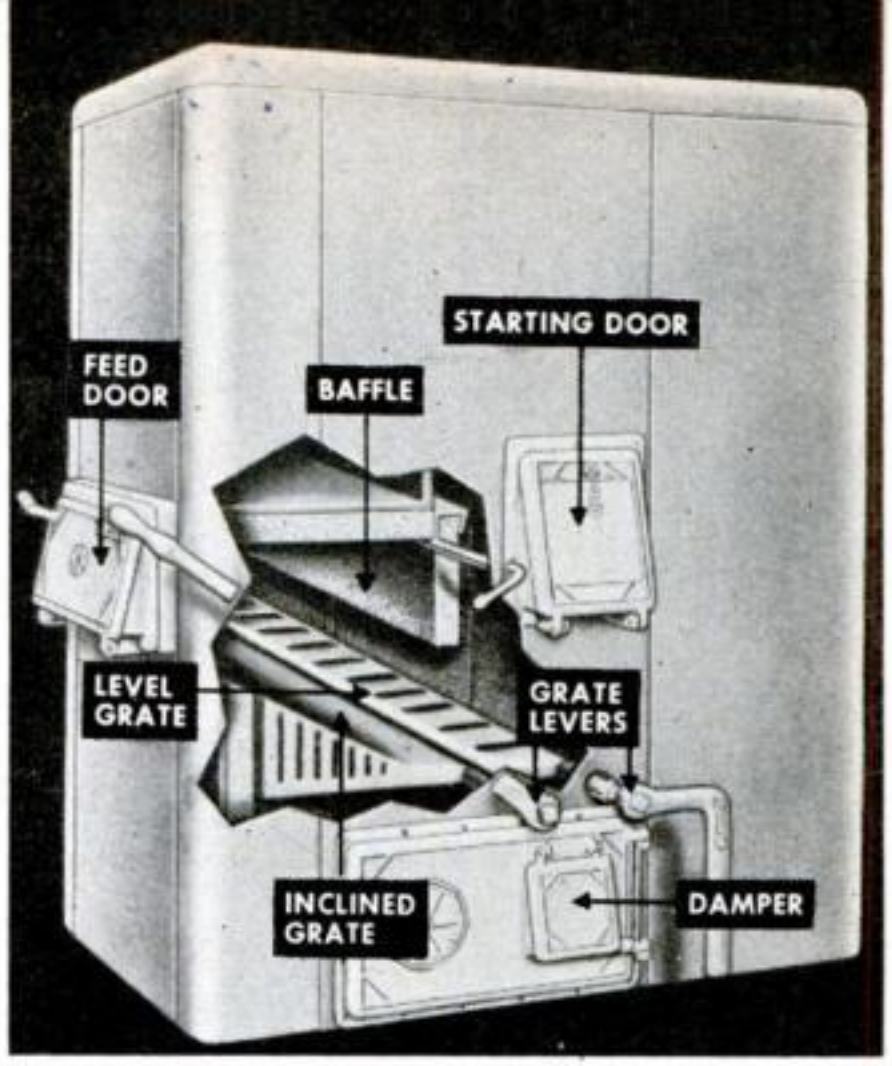


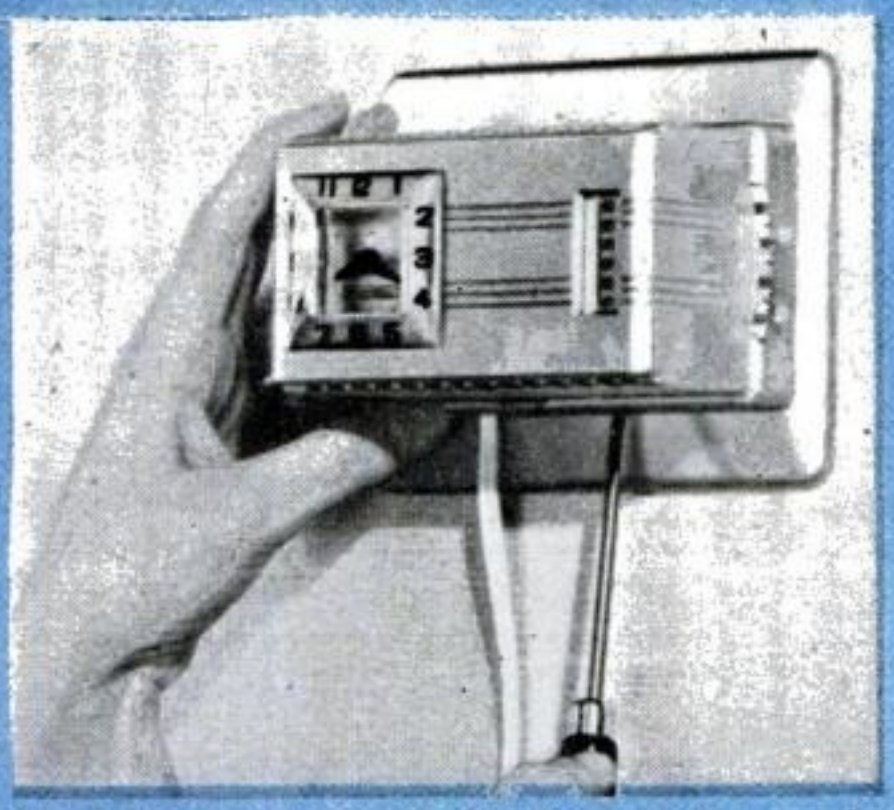
Sequence Control ® opens flue after oil burner stops, keeping chimney draft from wasting heat. Operated by the thermostat, it closes flue before burner turns on. Sampsel, Spring Valley, Ill., makes it.

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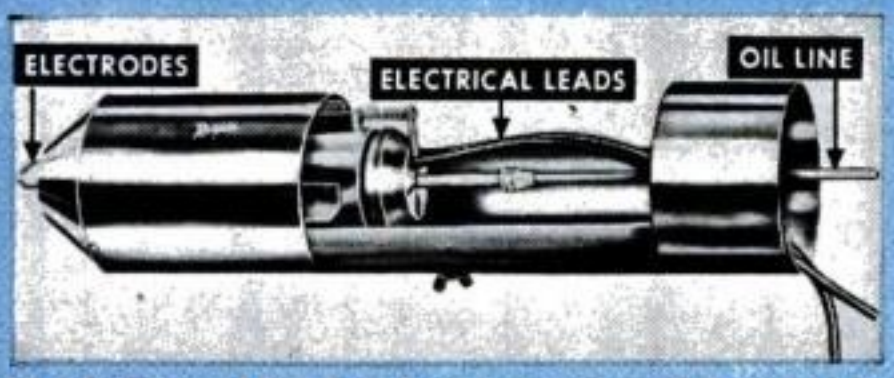


Soft coal is first coked and then consumed in a bank-firing heater made by the Worsham Co., St. Louis, Mo. With the fire going, ashes are dumped from level grate (1). Tipping inclined grate (2) moves hot coke to level grate. Coal is added (3). Latter cokes as other burns (4).

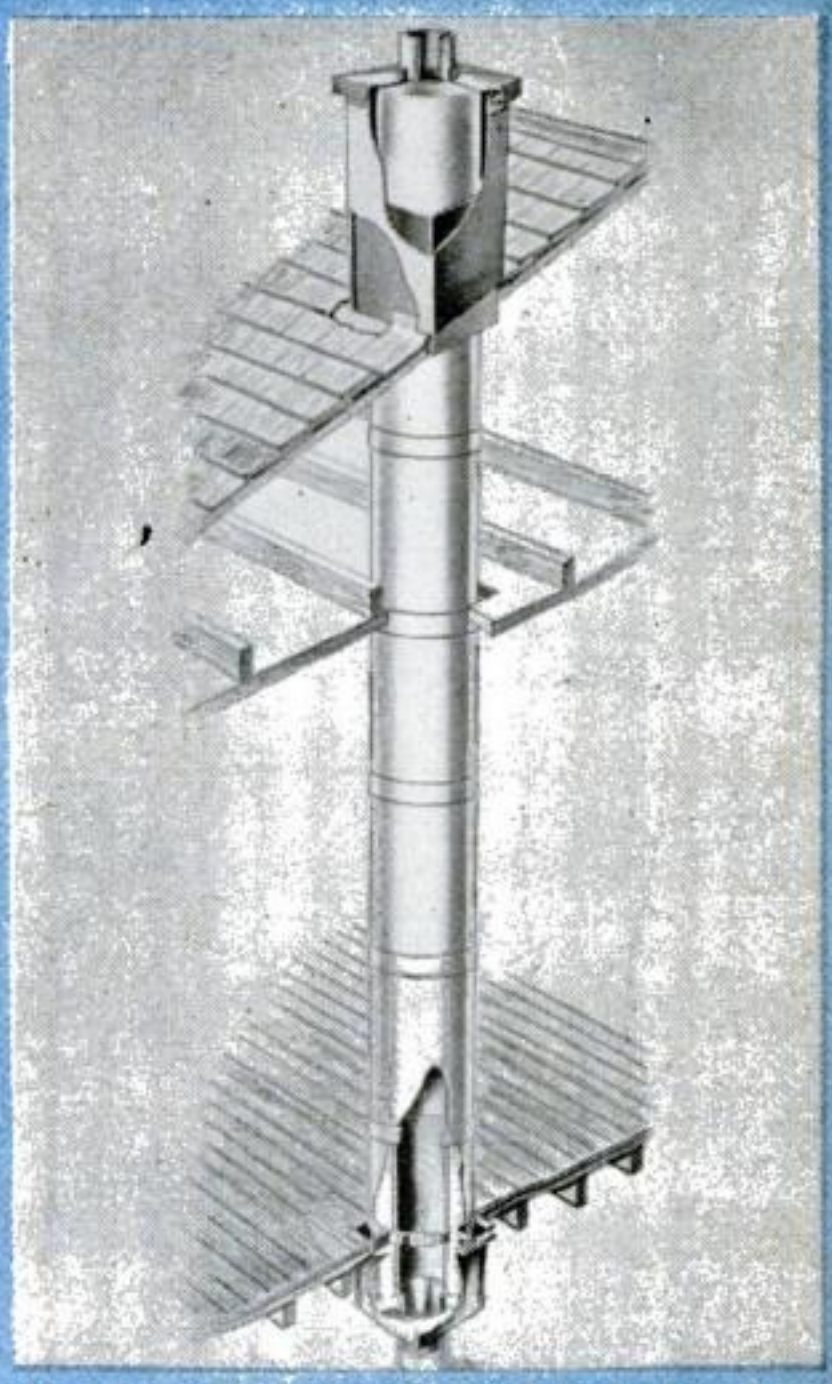




Clock thermostat made by Honeywell is quickly installed. It requires no transformer, since the clock uses a 115-volt motor instead of the 24-volt motor that's found in some others.



Turbulator Head ® for gun-type oil burners is made by Richfield Mfg. Co., Baldwin, N. Y. It gives the swirl and turbulence needed to mix air and fine oil particles, enabling you to burn new catalytic fuel oils efficiently.



Aluminum chimney marketed by Van-Packer Corp., Chicago, is so light that floor will support it, making foundation unnecessary. It can be installed in a few hours and costs half as much as brick.

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Grooving and Rabbeting with Woodworking Machines

With common power tools, accurately cut dadoes, rabbets, and grooves are only minutes in the making.

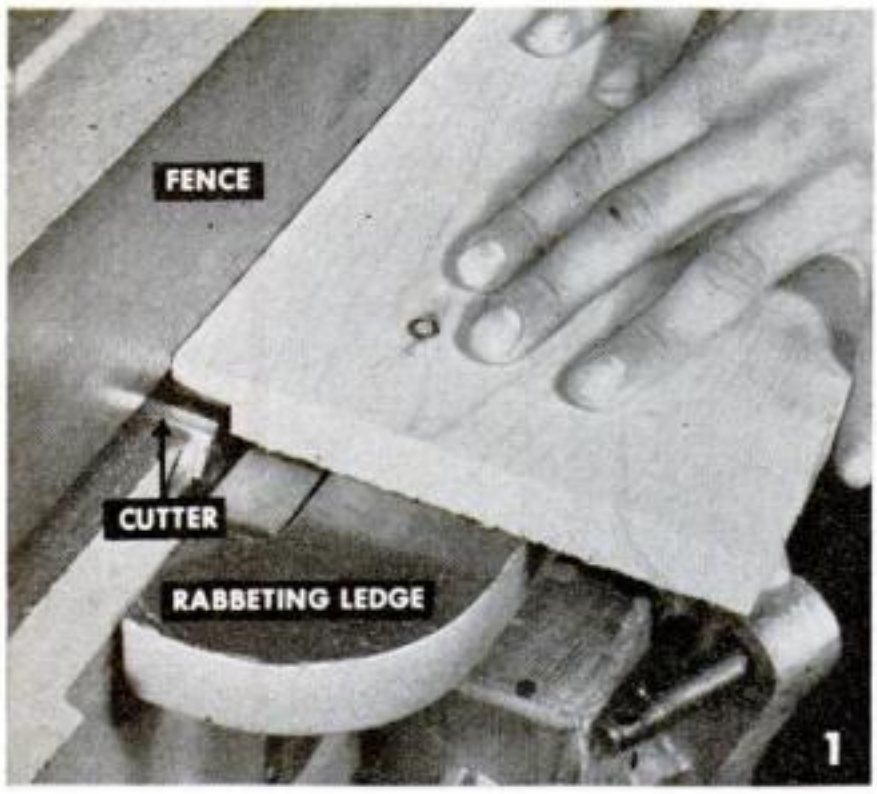
By Edwin M. Love

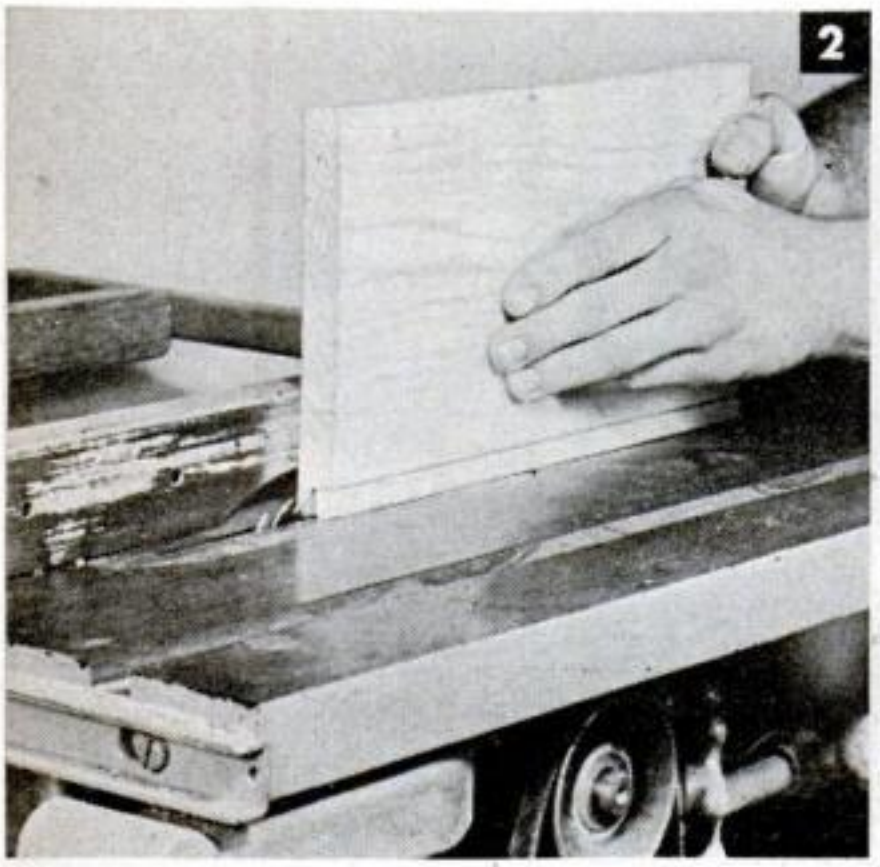
LIKE everyone else, the woodworker has to strike a balance between what he puts into his craft and what he takes out. The price of fine work is skill, time, and effort; his judgment tells him how much of the last two to spend on any given project.

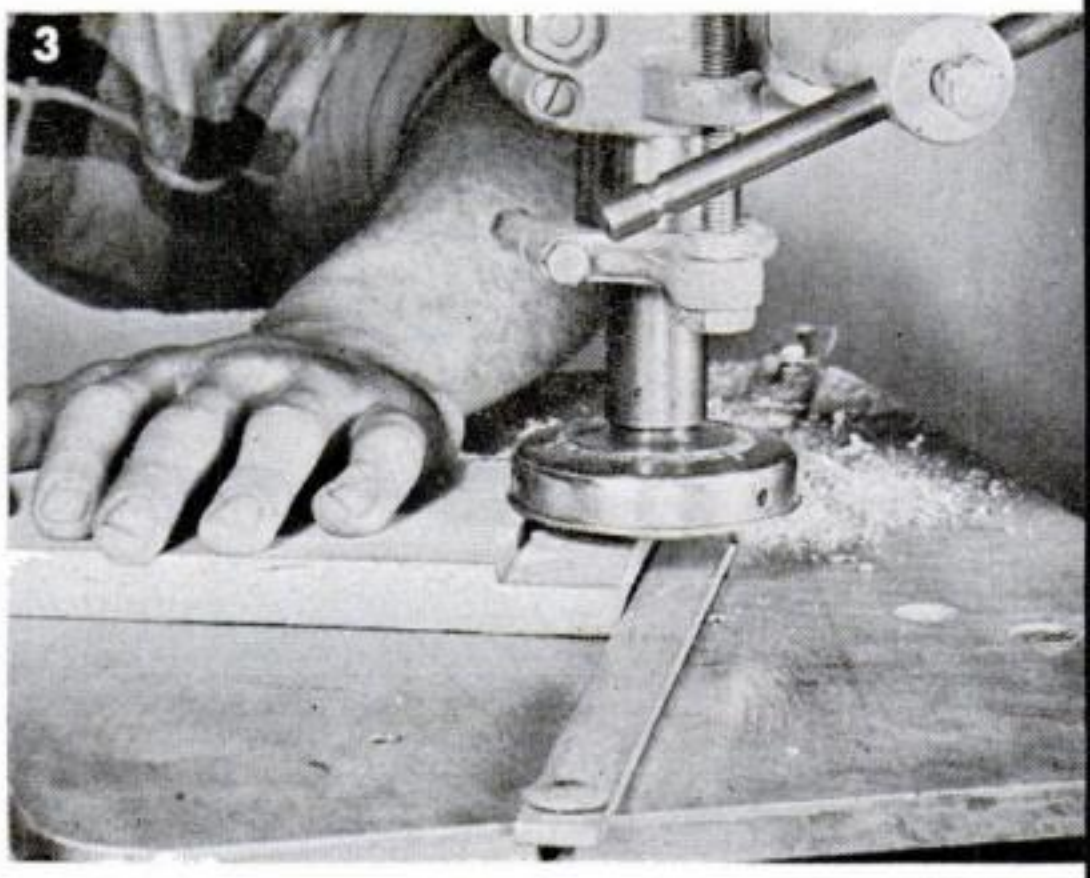
As was pointed out last month, grooves, dadoes, rabbets, and the like have many applications in cabinetry. When they have to be made with hand tools, you first want to consider whether the extra strength and neatness of the finished job make the extra work worthwhile.

With power tools these operations are so simplified that there is rarely any need to forego their advantages. Woodworking machines not only reduce the time and effort involved in doing the job, but they also save the worker hours of practice that would be needed to become expert in the use of hand tools.

A jointer is one of the most convenient machines for rabbeting. It has a projecting ledge or shelf on the edge of the infeed table which supports the work. Slide the jointer fence to the right until the cutters project the width of the rabbet desired. For very accurate work, make test cuts in scrap. Press the board firmly against the fence and table as shown in Fig. 1, and feed it over the blades. Note that the guard can't be used in this setup, so it's up to you to take extra precautions for your own safety. Most







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rabbets will be made in one pass, but two or more may be better in cross-grained or very hard wood.

On rare occasions you may have to make a narrow rabbet that is deeper (measured from a face) that the maximum depth of cut the machine can handle. In such cases, stand the board on edge as in jointing. By this method the depth of the rabbet will be limited only by the width of the cutter.

A jointer is sometimes used to rabbet the end of a board, but unless you have a holding jig, don't try it on a piece less than 5" wide. The method is essentially the same as edge rabbeting. Take special pains to hold the board level. Feed it in slowly, especially near the end of the cut, to prevent splintering of the rear edge as the cutters break through.

Many carpenters prefer the circular saw for rabbeting. It will make larger rabbets than almost any other tool. Two cuts are taken with an ordinary combination blade. Set the machine as for ripping, allowing the blade to project above the table by an amount equal to the depth of the rabbet. Cut into the face of the board. Set the fence again and saw the adjacent side of the rabbet as shown in Fig. 2. If the rabbet is to be square in section, you can save time by leaving the fence setting unchanged and sliding the rabbeted face against the fence for the second cut. While this imprisons the waste stock between the board and the fence, it gives added safety by keeping the blade behind the work.

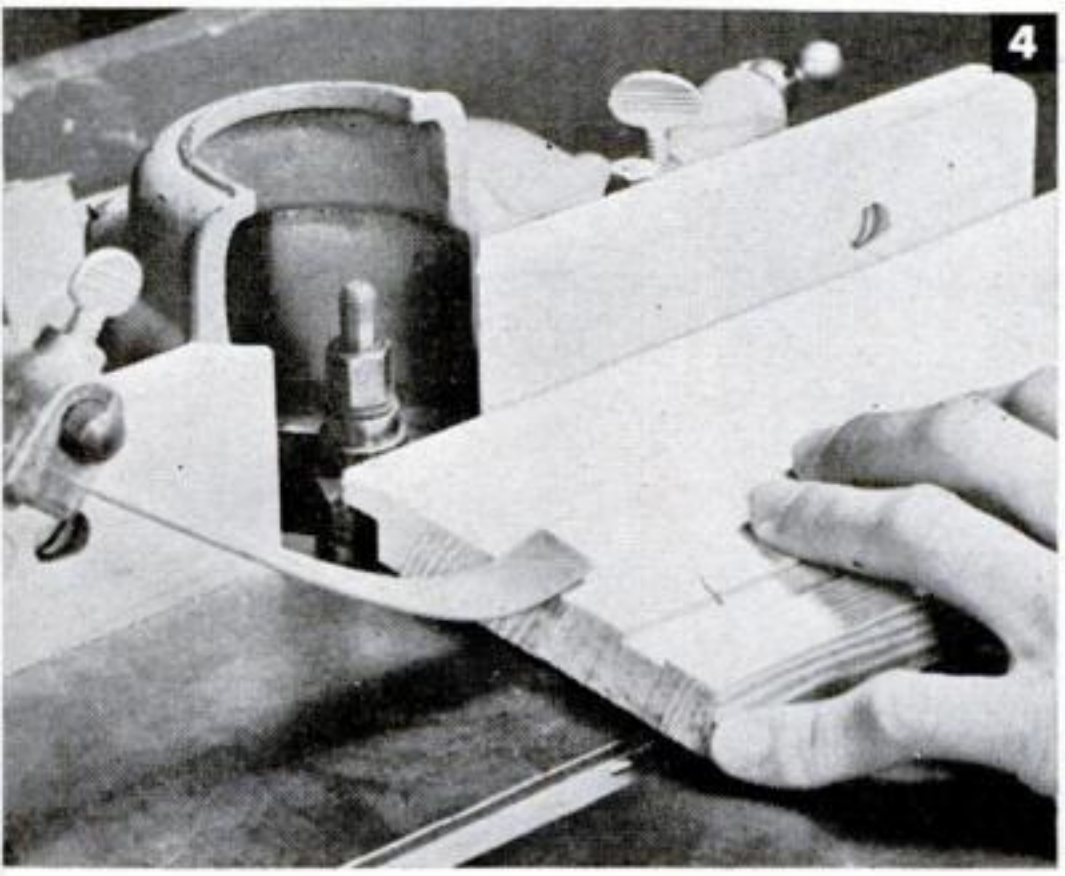
A drill press equipped with a rotary planer is an efficient tool for making shallow rabbets. Set the machine as for planing, adjust the fence for the correct width (this may have to be done by taking a test cut in scrap stock), and plane out the rabbet as pictured in Fig. 3. An end rabbet is shown here, but the technique is exactly the same for an edge cut. If greater width is required, simply shift the fence and make two or more passes.

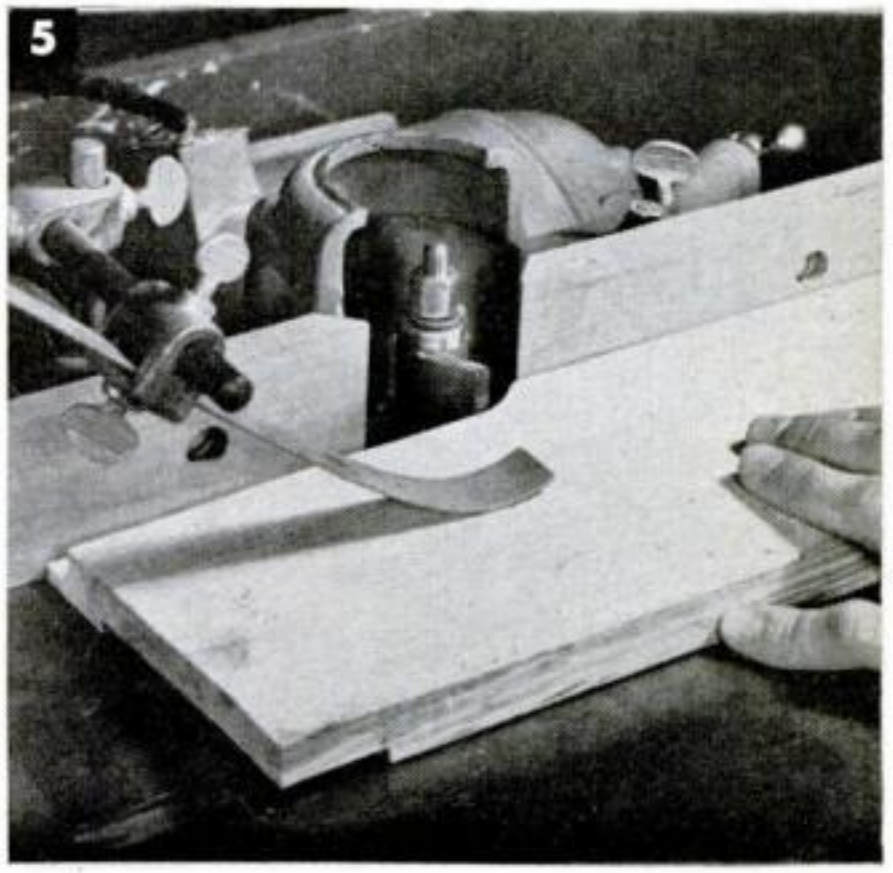
The versatile shaper rates high in cutting rabbets. Mount a straight-edged cutter on the spindle and clamp the fence where it will allow the knives to cut to the required depth. The fence faces must be set in a straight line. A rabbet can be cut on the upper or lower side, according to circumstances. If below, as in Fig. 4, the cutter will be hidden by the work. This is a valuable safety feature; it also insures that—regardless of thickness variations in the lumber—the rabbet will be uniform on all pieces processed at the same setting.

Sometimes the important dimension is the thickness of the tongue rather than the depth of the rabbet. In such cases, set the cutter above, as in Fig. 5. Then the tongue will always be uniform regardless of other variations.

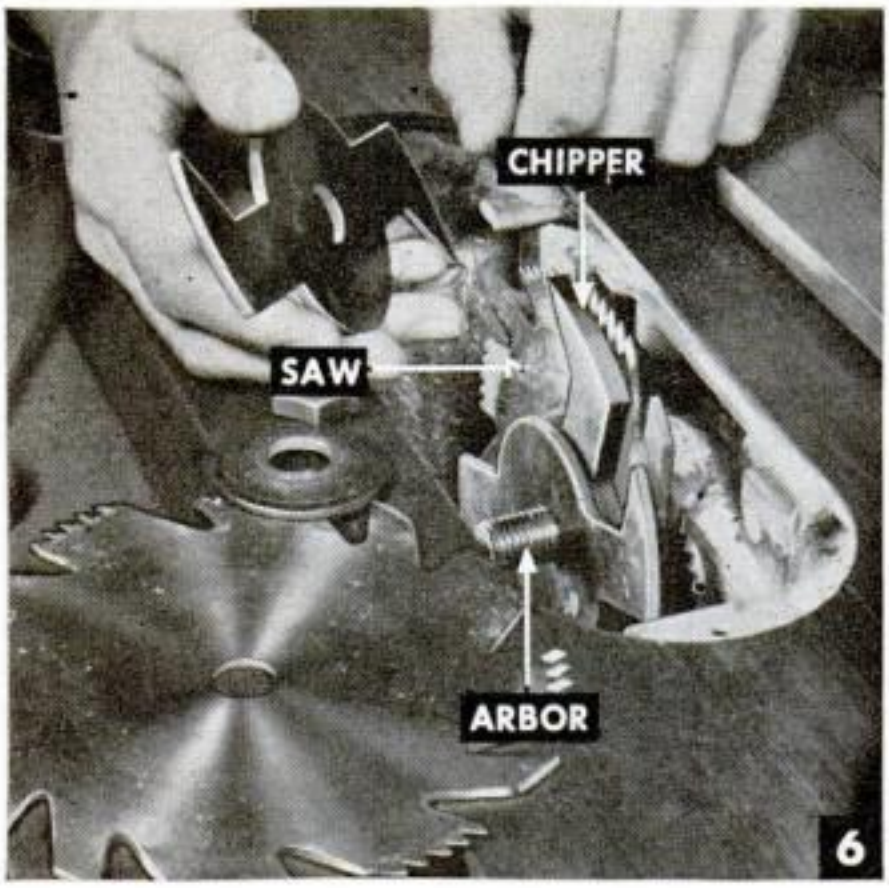
In all cases feed the work against rotation of the blades. If the shaper is reversible, favor the grain by cutting with it whenever possible. Use mechanical hold-downs for greatest safety.

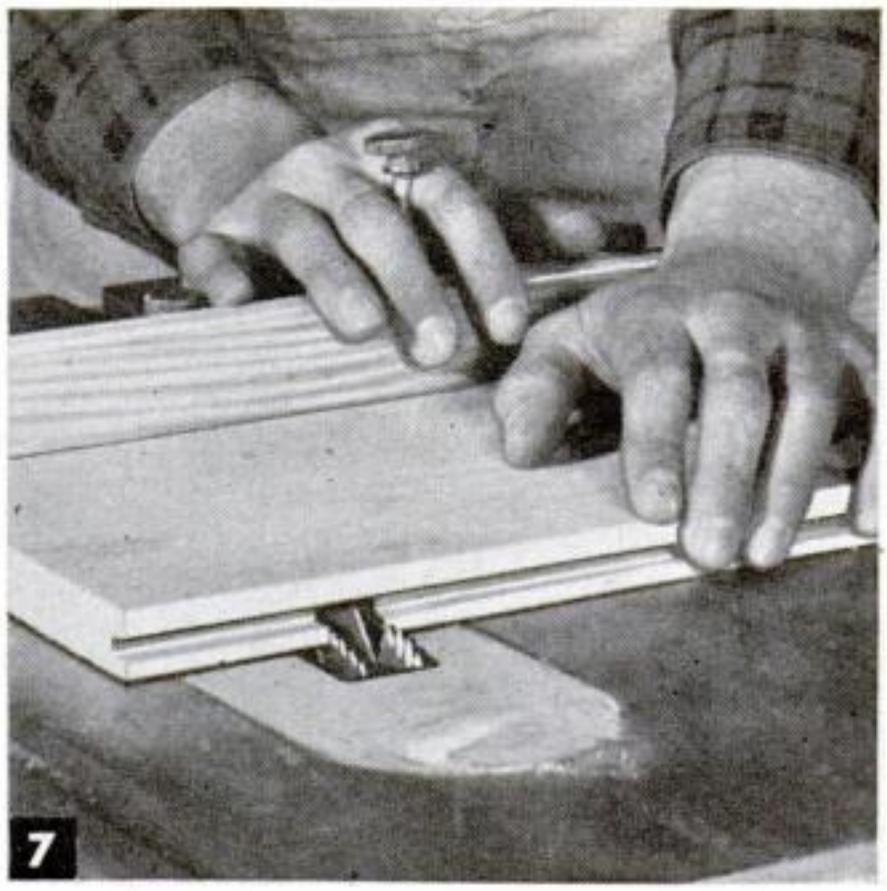
Making a dado is a fairly involved task with hand tools, but it's a single-pass job on a circular saw equipped with a dado head (Fig. 6). A dado ⅛" wide calls for one saw blade; two are required for a ¼" cut. Wider ones are made by sandwiching "chippers" between the blades. The cutting edges of the chippers are placed at the openings be-





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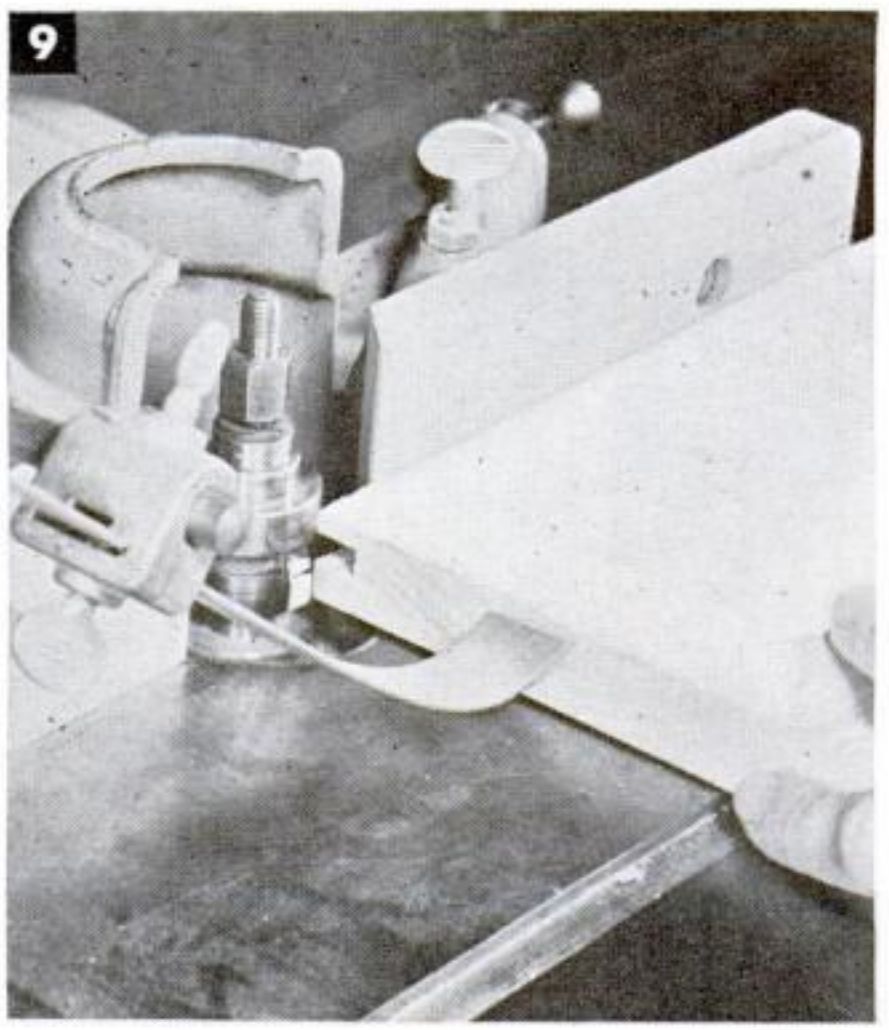
tween the saw tooth groups. Dadoes of varying width can be made by using different combinations of inside cutters. Add paper washers for fine adjustments.

A dado is usually cut as shown in Fig. 7. The miter gauge is used to keep the workpiece exactly at right angles with the blades. Note the wooden auxiliary fence that is screwed to the miter gauge. It supports the back edge of the work and prevents splintering, while giving a substantial base for long pieces.

Grooves made lengthwise of the lumber are cut in an operation similar to ripping, but using a dado head. For edge grooving, slide the board on edge with one face against the fence. Grooves can also be made with a "wobble" saw, which is an ordinary blade that is set at an angle with the arbor. A pair of washers thinned at one end cause the saw to run out of true. The extra side swing cuts a kerf wider than normal. Tapered washers can be made of plywood, or you can buy a set of steel ones calibrated to show the amount of wobble. The edges of a groove or dado cut with a wobble saw will be angled unless it is made in a series of shallow cuts.

A blind dado is made by stopping the forward motion of the wood before the head cuts through the edge. Clamping a block to the table will limit the stroke accurately





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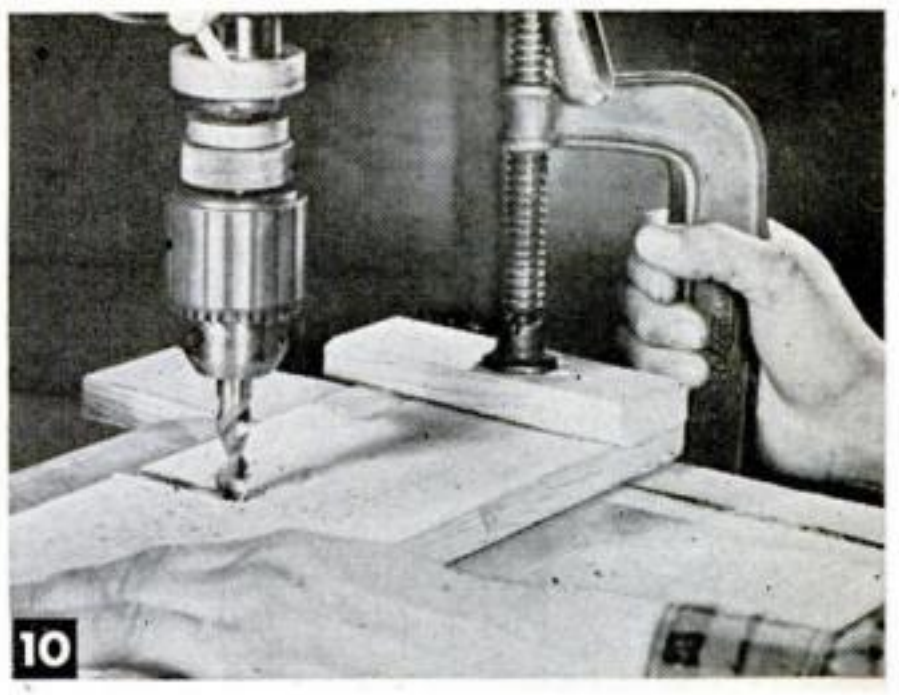
and automatically. If both ends of a dado are to be left blind, clamp a starting block where it will prevent kickback of the piece as it is lowered over the cutters. When necessary, the ends can be trimmed square with a chisel.

Blind grooves are made in a similar manner. To handle long stock, screw an auxiliary fence to the regular one and clamp the stop blocks on it.

End rabbeting with a dado head is illustrated in Fig. 8. To make a similar cut along an edge, use a molding head and keep the unwanted section of the head under the arch of the fence. If the regular fence is not arched, attach an auxiliary wooden one that is.

Grooving on a shaper, shown in Fig. 9, is very similar to rabbeting. Use a cutter the same width as the desired groove and raise it above the table as required. The same procedure can be followed when a drill press is used as a shaper.

For face dadoing and grooving, the drill press is used with a router bit held in a solid chuck and run at highest speed. Clamp a strip of wood to the table or use an auxiliary table and fence. Adjust the fence to

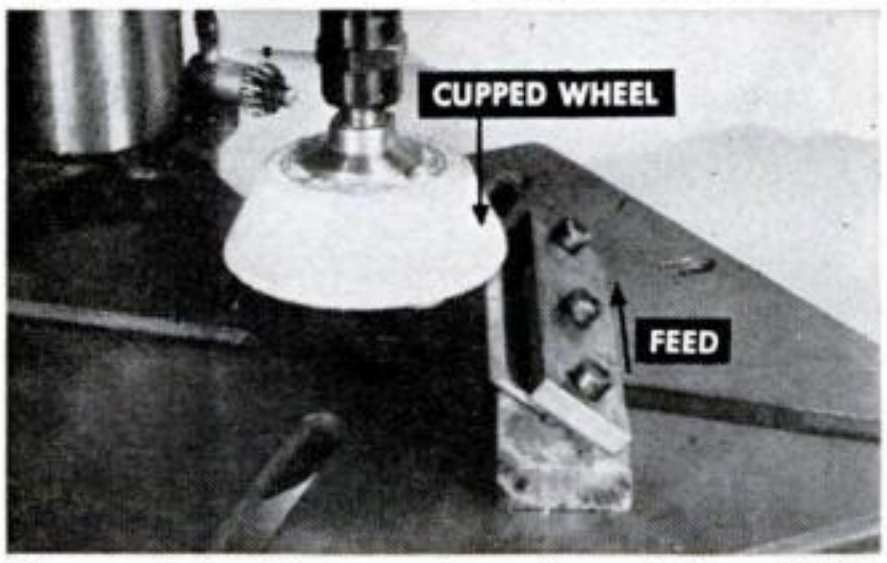


bring the router the desired distance from the edge of the piece. Lower the bit for the depth of cut, lock the quill, and feed the work from left to right. If the cut must be made in more than one pass, make all successive cuts in the same direction.

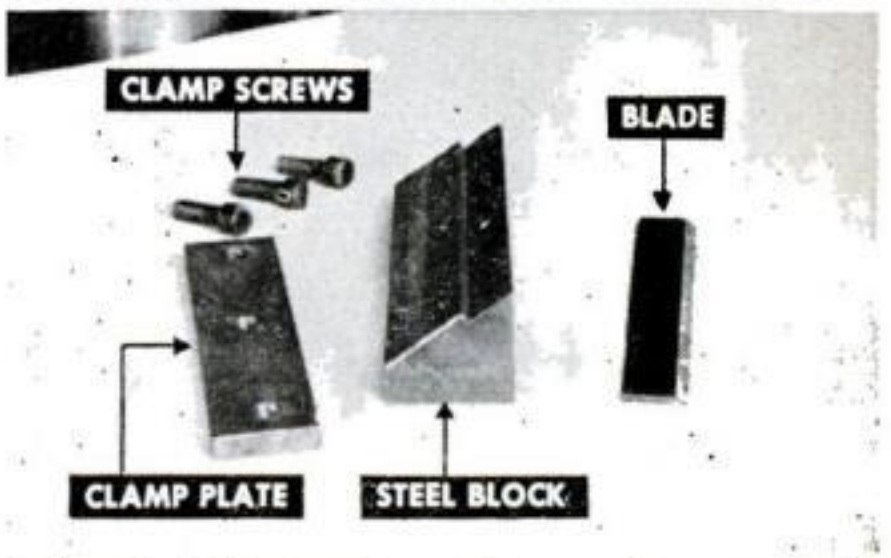
A simple method of guiding the router in dadoing is shown in Fig. 10. Clamp a straight-edged strip to the underside of the board, making it parallel to the dado. Set it so it can slide against the end of the auxiliary table or the edge of the drill-press table, and push the work. END

5/85

Drill Press and Holder Sharpen Jointer Blades



Clamped in this two-piece jig, a jointer blade can be precision sharpened on the drill press.



A beveled block, clamp plate, and screws make up the jig. Size and angle should suit blades.

A STEEL block beveled to the proper angle will enable you to use your drill press for precision sharpening of jointer blades. The jig shown in these photos is used with 4" blades.

Mill or saw the steel block to the correct angle and width. The grinder setup illustrated can be used to finish off the seating surface of a partially finished block. Cut a clamp plate, put it in position, and drill and tap the block for the two or three screws needed to secure the clamp.

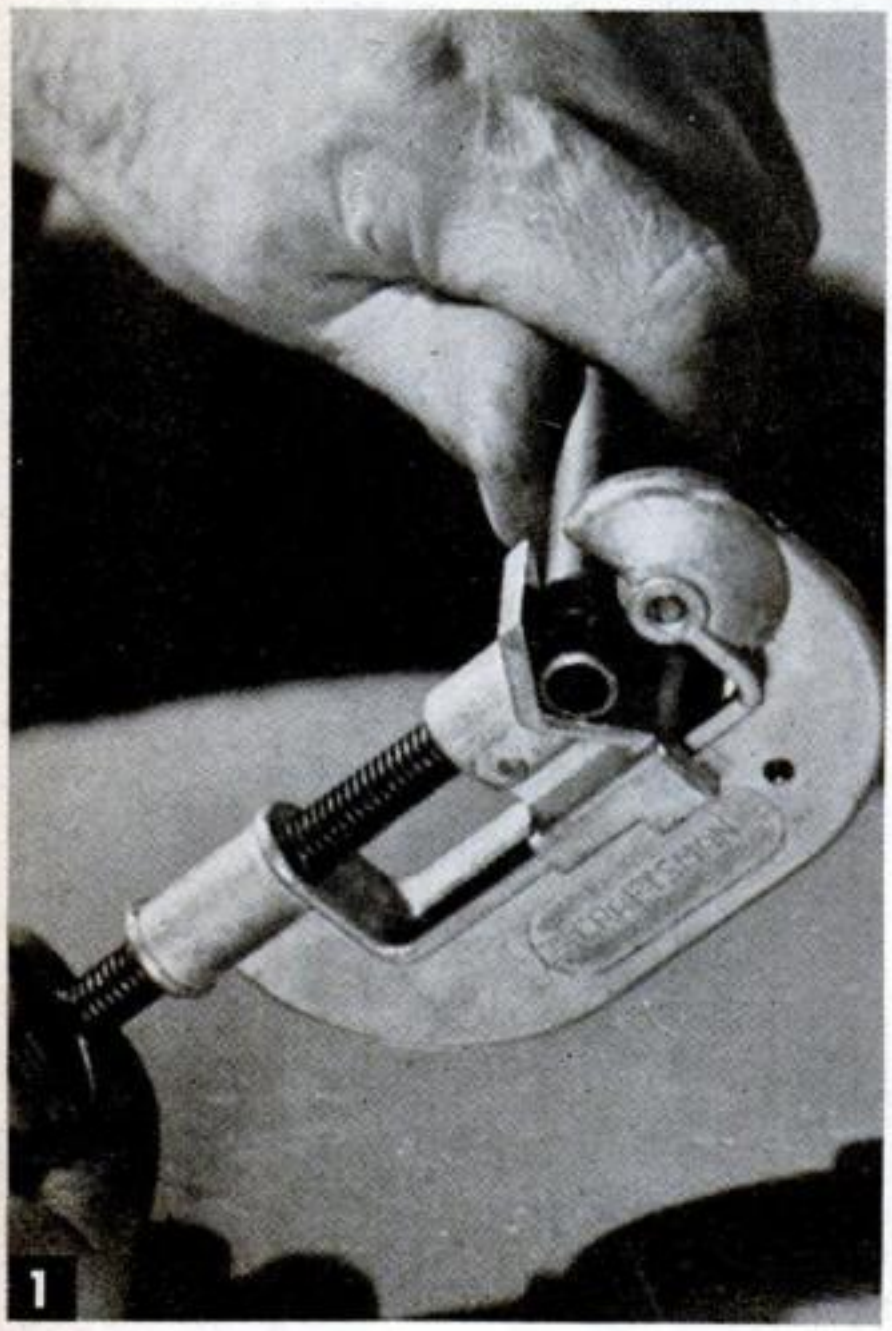
In use the blade is locked in the jig and the cupped grinding wheel—run at 5,200 r.p.m.—is lowered into light contact with the edge. Set the drill-press depth gauge for a light cut.

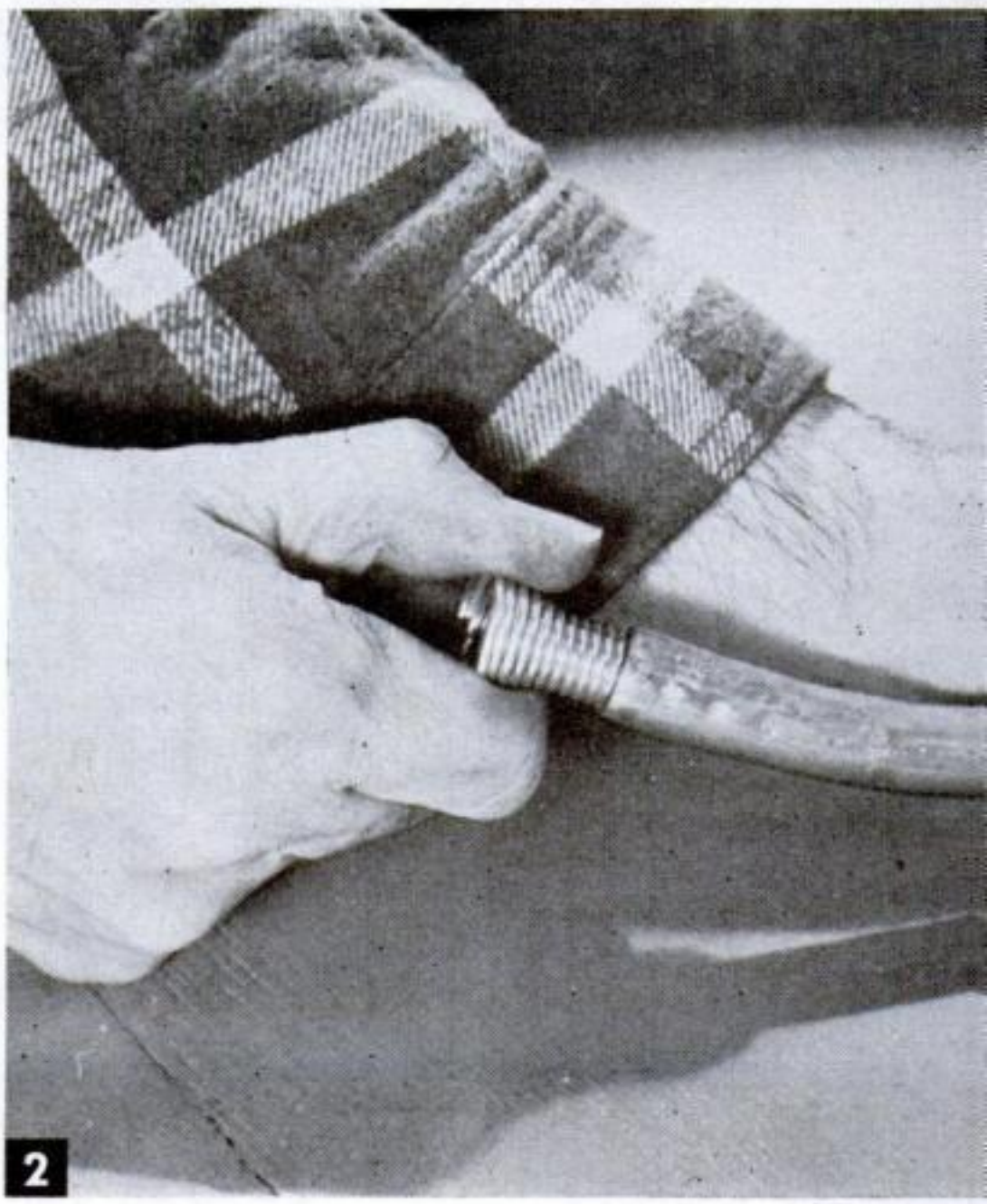
Hold the jig firmly on the drill table and feed it carefully under the grinder by hand. After each pass the depth-gauge stop screw is backed off slightly to permit another cut. If the final pass is very light, little honing will be required.—*E. F. Lindsley, N. Prairie, Wisc.*

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How to Use Copper Tubing





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Fine for refrigerator and auto plumbing, this material has dozens of shop and craftwork uses besides.

By Walter E. Burton

WANT running water in your darkroom? Or cutting oil fed to your lathe? Maybe you have a handmade tray that calls for something special in handles, or want to make a modern small photo frame. For any of these, copper tubing may be the answer.

You can cut tubing with a hacksaw. But this produces ragged edges that have to be squared with a file. If you're going to do a lot of work with tubing, a special cutting tool, as shown in Fig. 1, is preferable. Even such a tool, though it cuts the tubing squarely, sometimes produces burrs. You can buy a deburring tool, but a countersink—the kind used on wood—and a file will be satisfactory. Use the countersink for internal deburring and remove outer burrs with the file.

Copper tubing is easily bent. However, you must take care not to collapse the tube walls. To guard against this, use coil springs or a filler material that can be removed after the bend is made.

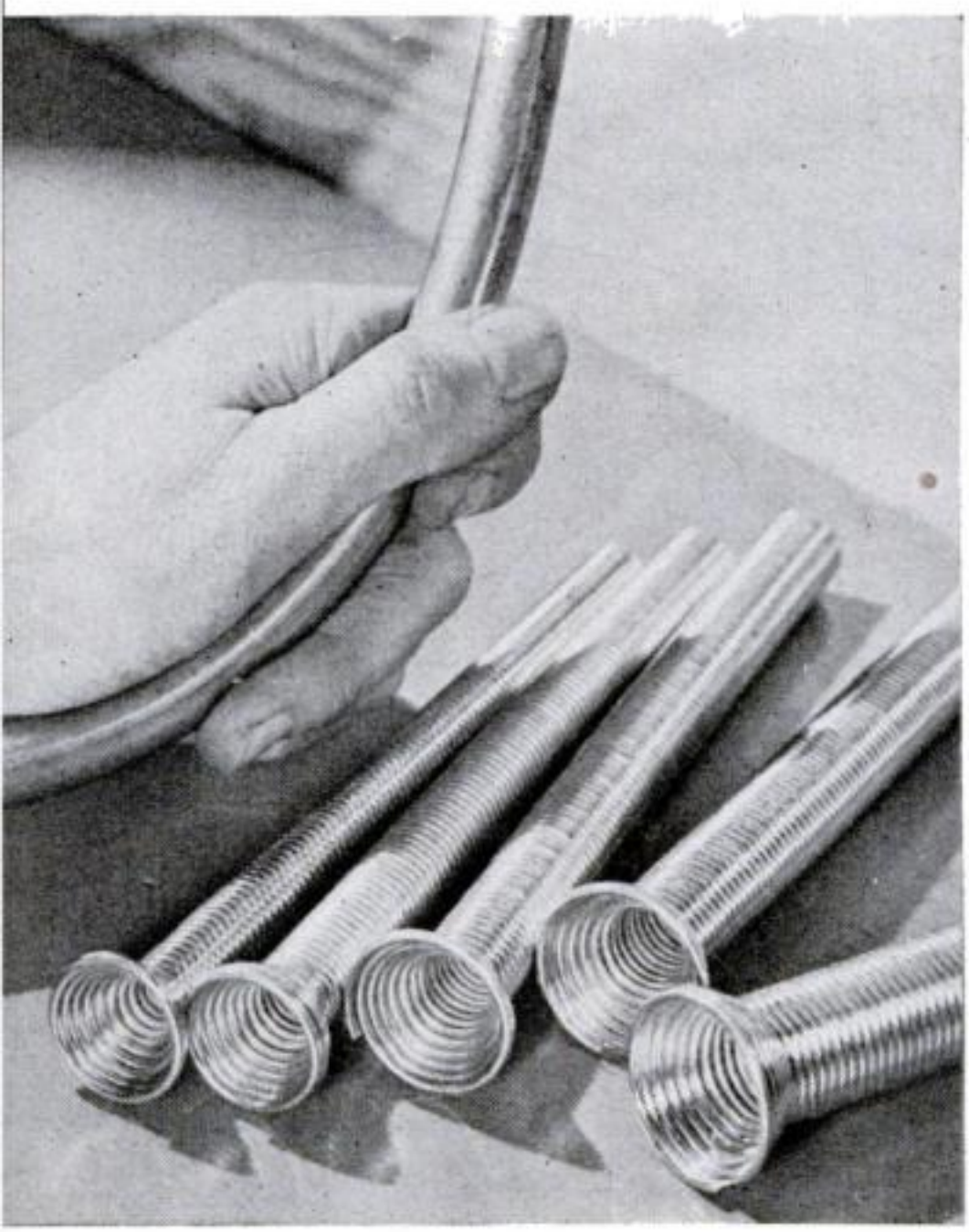
Figure 2 shows a set of tube-bending springs you can buy. They're used inside only when the bend does not extend beyond the length of the spring. For bends of greater length, slip a spring over the tube and shift it as you make the curve.

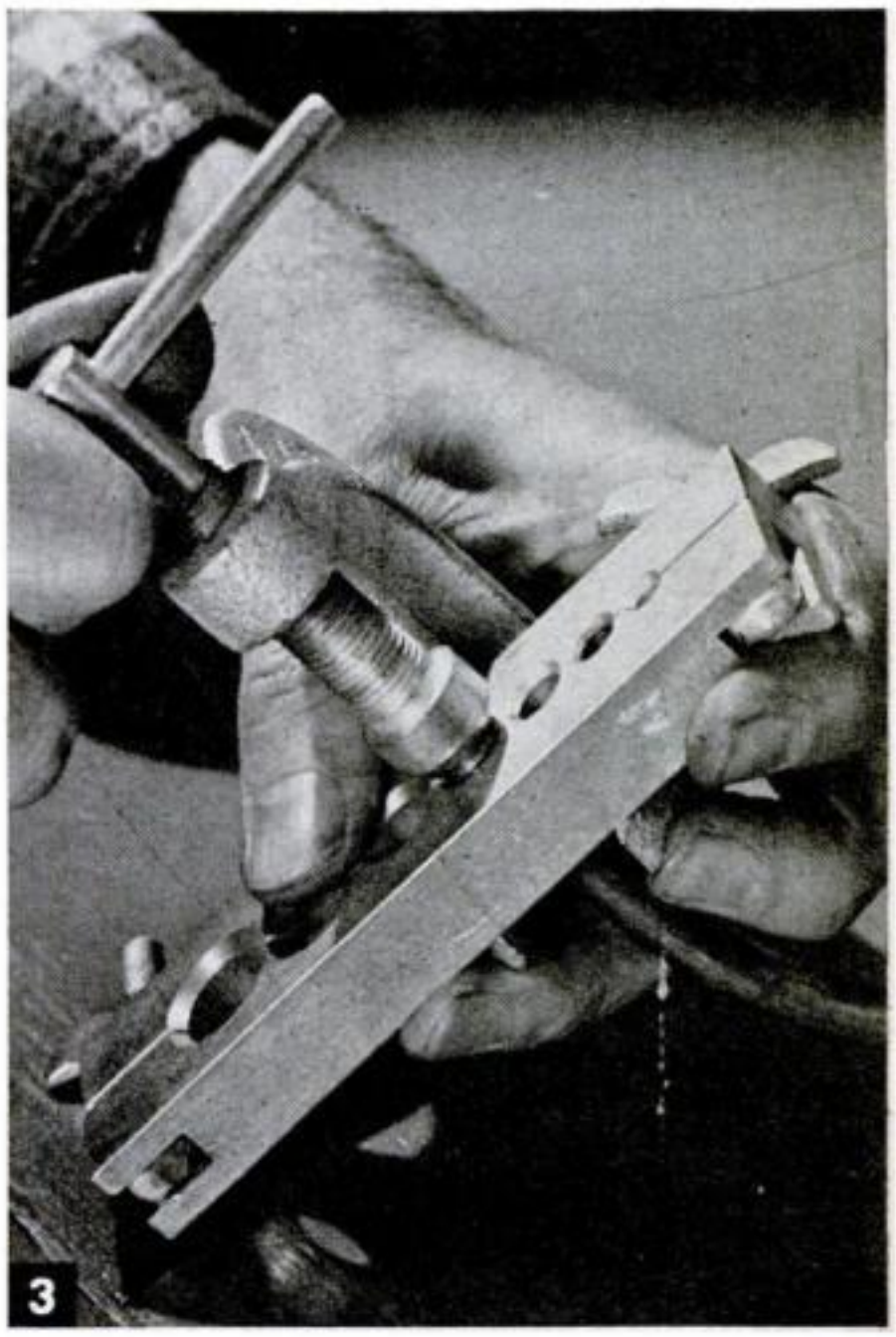
Among the fillers for bending are resin, tar, very fine shot, salt, lead, solder, sand, and special alloys with low melting points. Lead and solder require considerable heat to melt them out of the tube after the bend is made. The special alloys can be flushed out with steam or hot water.

Bending may harden the tubing enough to make it brittle. If further bending is necessary, anneal it first by heating it red hot and letting it cool in air or water.

When you get into work with larger tubing, a simple help for bending is a wooden block with a hole in it slightly larger than the tube diameter. The big photo on the facing page shows such a block in use. Clamp the block in a vise and move the tubing through the hole a little at a time, bending it at each step.

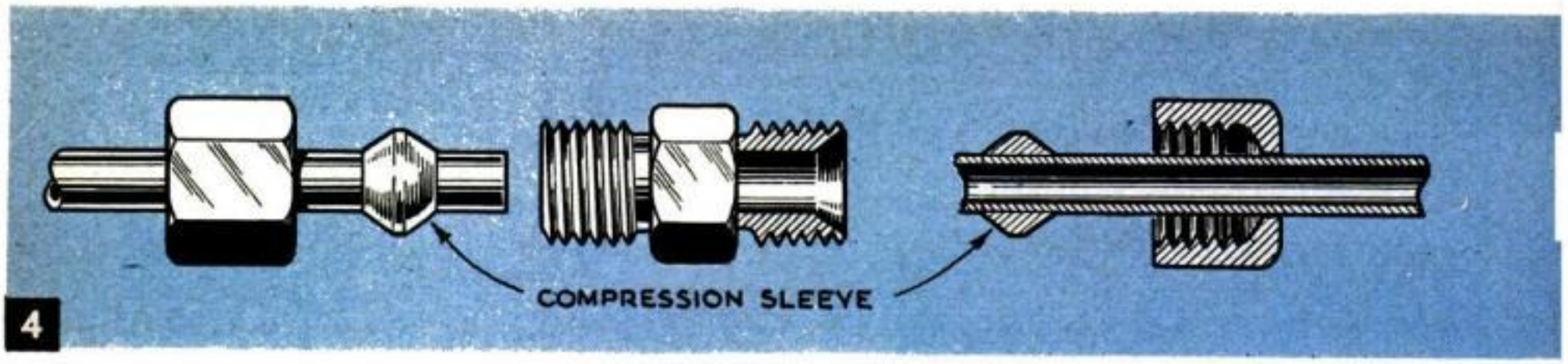
There are many ways of joining tubing or of connecting it to iron pipe. Plumbing shops sell tees, elbows, caps, and other fittings, or you can solder the joints. On smaller tubing, threaded fittings are usually em-





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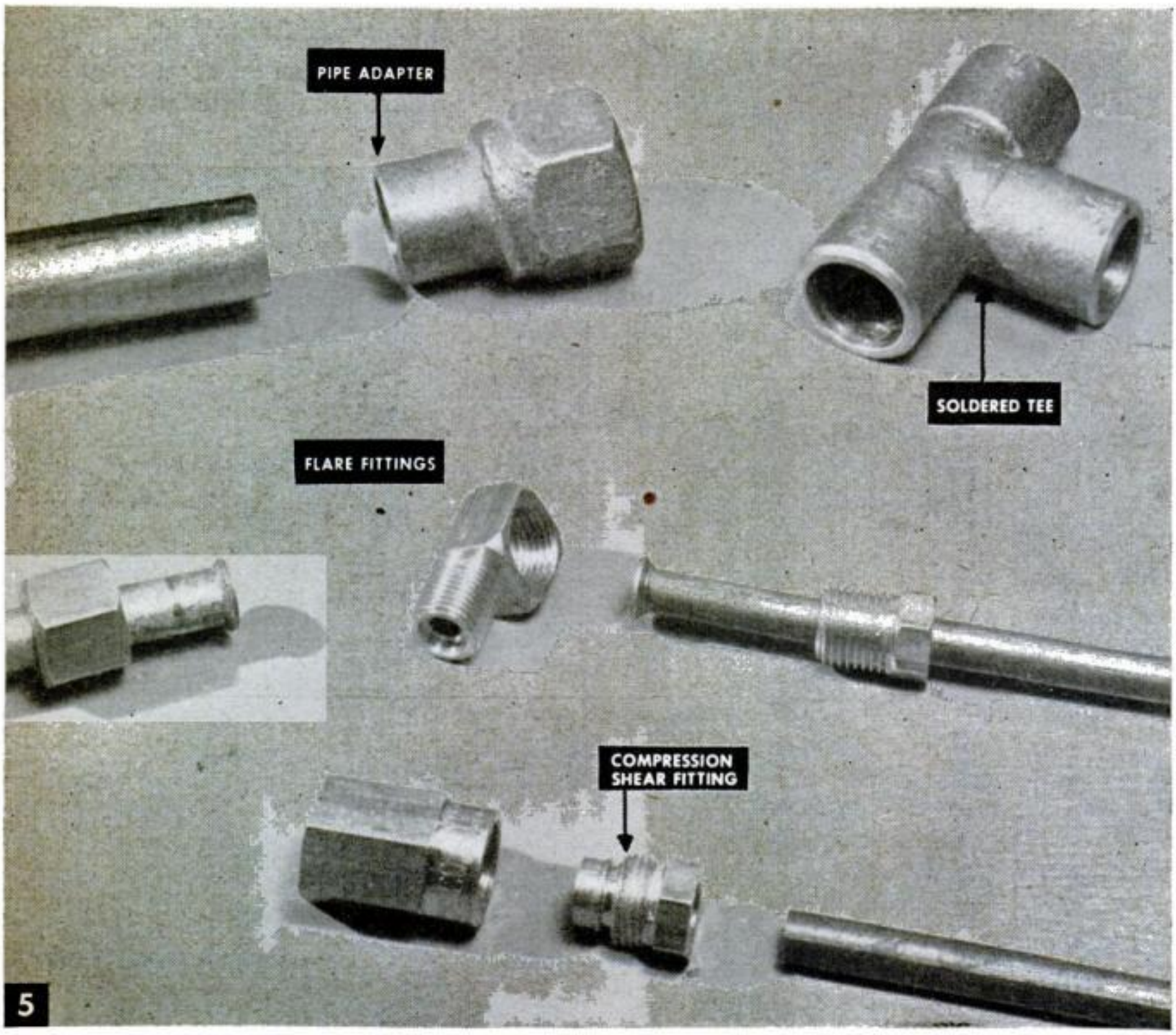
ployed, while larger, plumbing-size tubing generally has soldered fittings.

A flared tube end with a compression fitting is one of the most widely used means of joining tubing. A flaring tool, Fig. 3, clamps the tube end in a chamfered hole while a conical tip forces the tube walls outward. Before flaring, however, a nut is slipped over the tube, as shown in the center of Fig. 5. The nut then is tightened to force the flare against the other fitting.

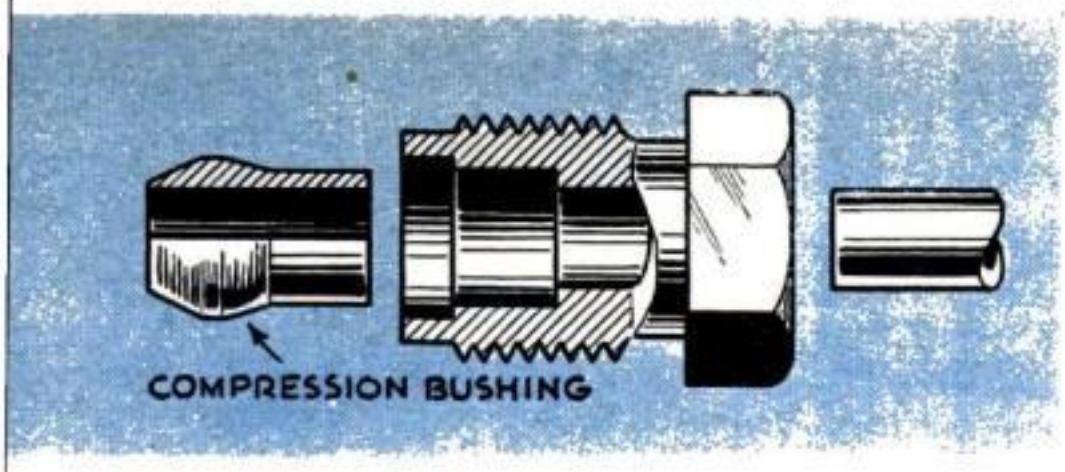
The compression fittings in Fig. 4 squeeze the joining parts tightly against a sleeve or ring gland slipped on the tubing. The fitting shown at the bottom of Fig. 5 has a collar that shears off to form a sealing ring when the nut is tightened.

Two soldered fittings are shown at the top of Fig. 5, while Fig. 6 shows a female pipe adapter being soldered to a tube. In Fig. 7, a male adapter soldered on the tube is being fitted.

One of the simplest methods of joining two tubes is to slip one over the other, sweat them together, and then wipe solder over the joint. This is illustrated in Figs. 8 and



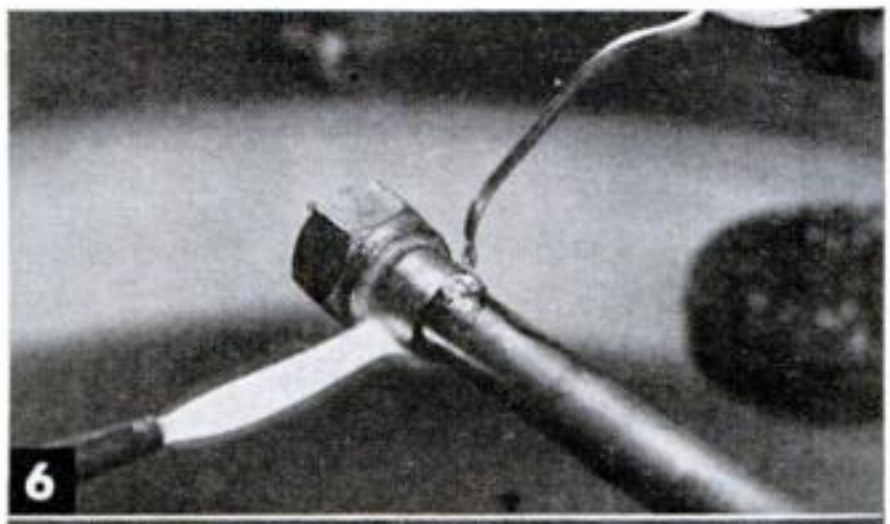
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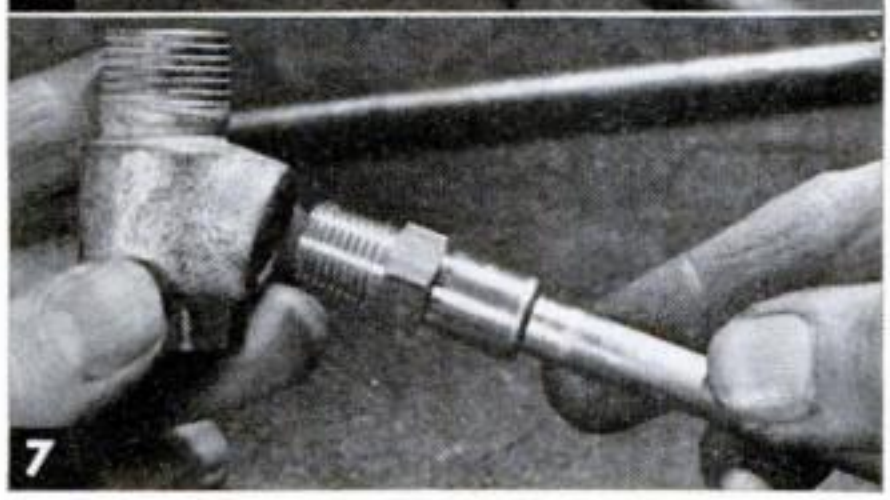


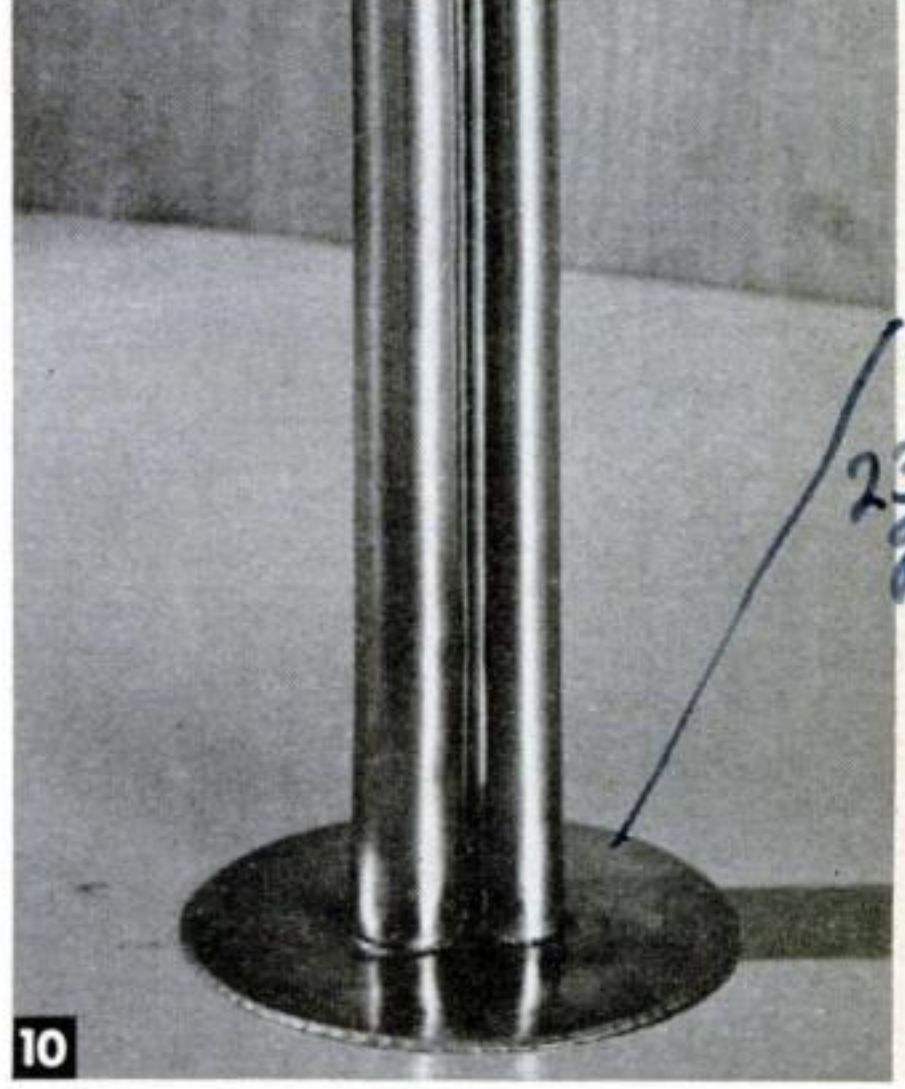
9. If the tubes are the same size, flare the end of one enough to fit over the other.

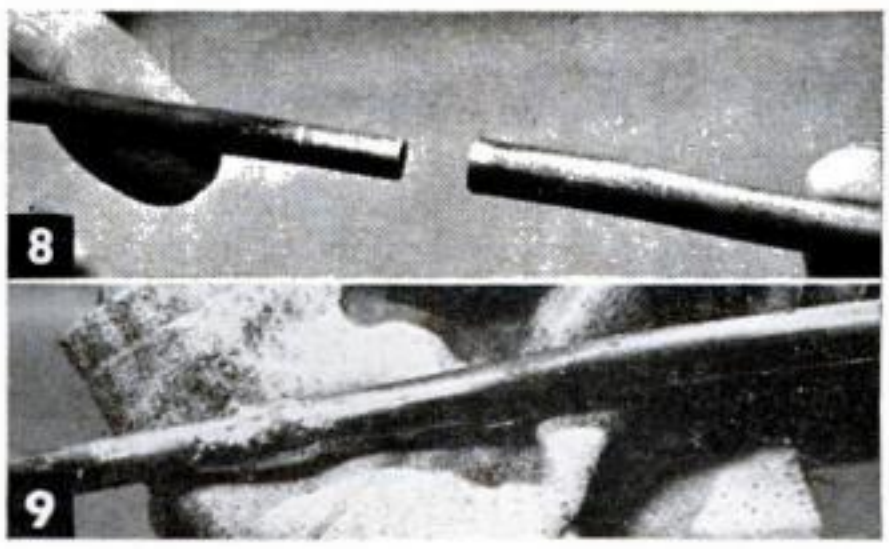
Copper tubing has unlimited possibilities in decorative craftwork. Shown in Fig. 10 is a bud vase made of three sizes of tubing soldered together and sweated to a base. The tubes were polished on a wire wheel and coated with clear lacquer. The key ring, Fig. 11, is made of ¼" o.d. tubing bent and joined with a copper brazing alloy.

It is wise to coat the finished project with clear lacquer after buffing, to avoid tarnishing. END


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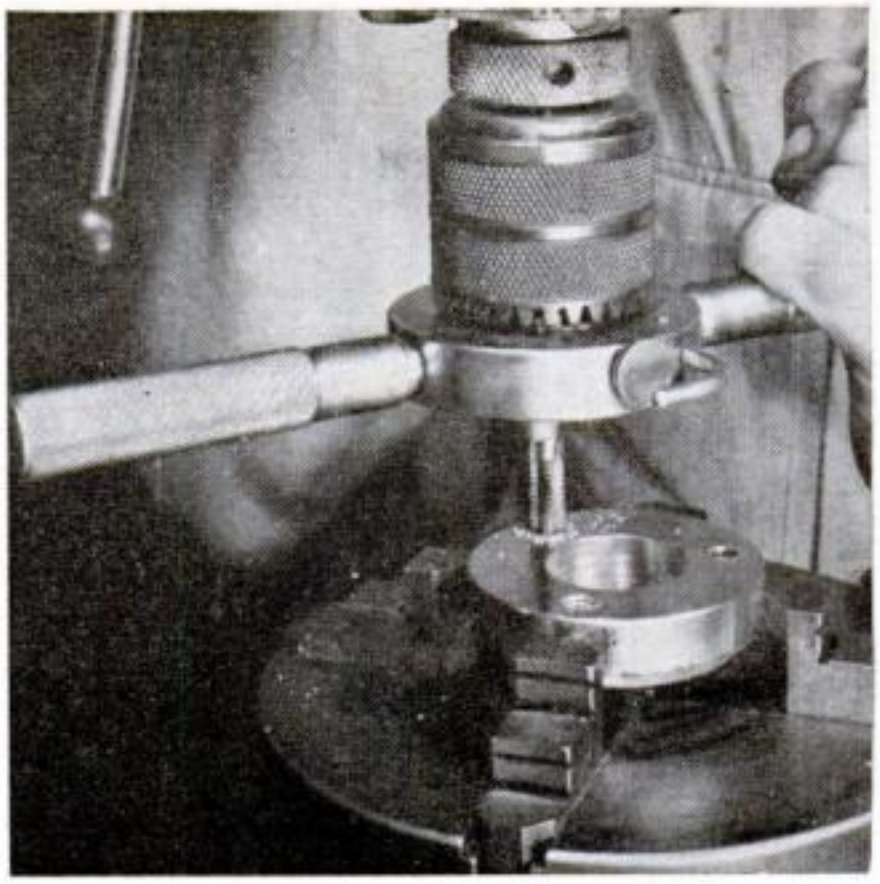
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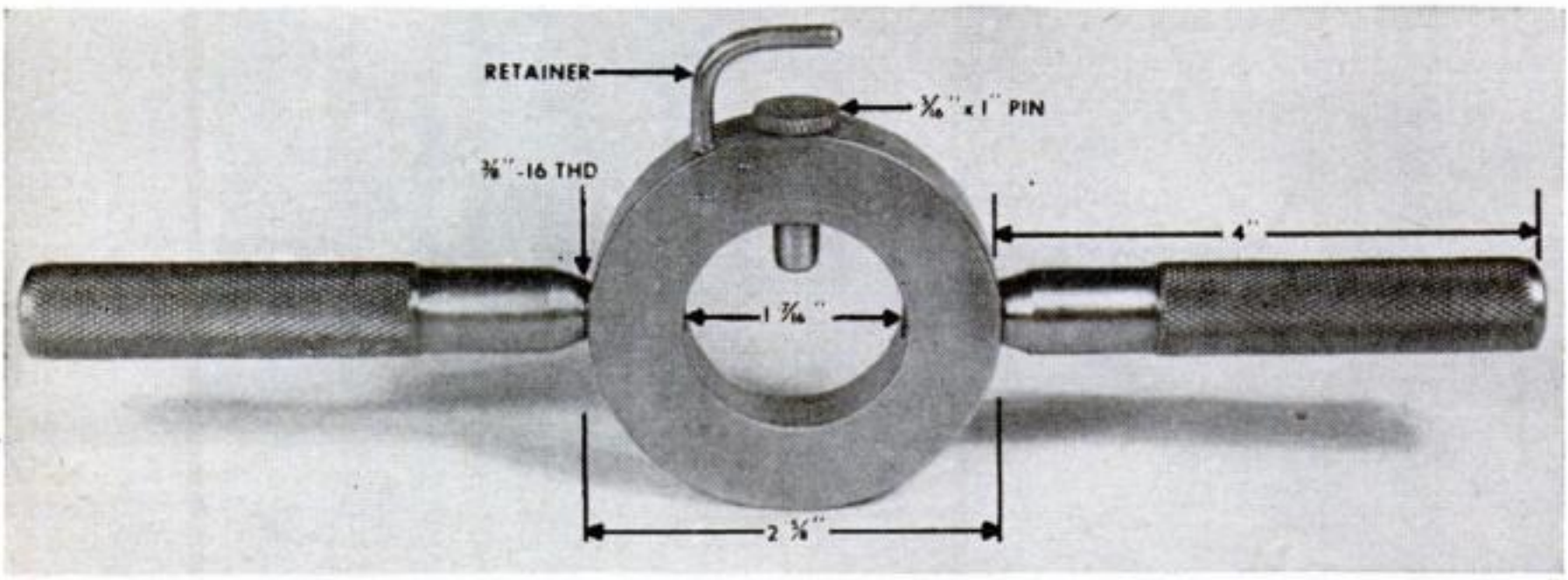
NEW SHOP IDEAS

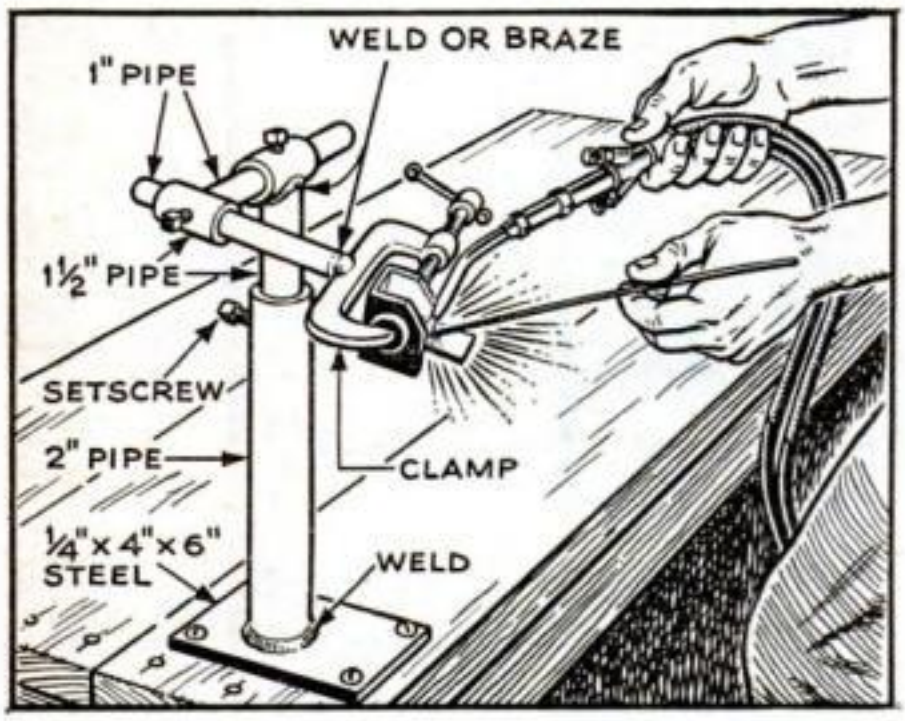
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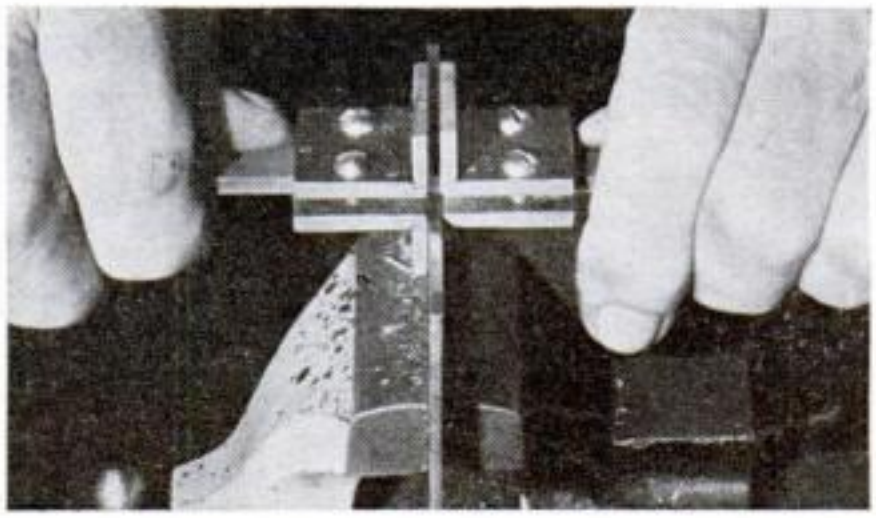
Grip Turns Taps. Your drill press will tap holes with the same precision it drills them. But lacking a special chuck, you can't use motor power, and turning the chuck by hand isn't easy. This gadget, made of cold-rolled steel, furnishes the grip you need.

Made for a Jacobs ® chuck, the tool is a steel ring tapped to receive two threaded handles and fitted with a sliding pin that enters any of the chuck-wrench holes. The pin is retained by a bent rod driven into the ring. In use, the tap is first tightened in the chuck. Then the handle is slipped on.—*John A. Bates, Wise, Va.*





All-Angle Welding Clamp. Needing a fixture that would hold work in any position for welding, I made this one from odds and ends of pipe. Smaller pipe would adapt it for more delicate work. Use sections that telescope easily into each other. The three slip joints give directional and height adjustment.—*Gordon Siniard, Barryton, Mich.*

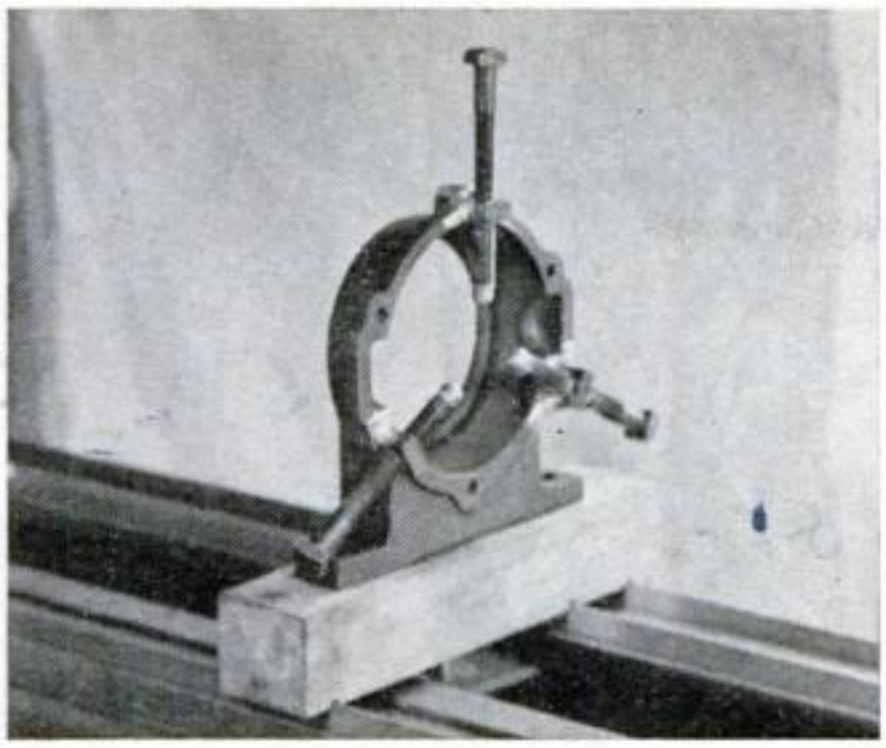


Jig Aids in Drawfiling. It's difficult to finish edges squarely by hand unless you're a whiz with a file. But the jig above makes a true, smooth edge almost inevitable. It consists of four pieces of steel angle, two tapped 8-32 for clamping bolts, and the others drilled clearance size. The length of the sections, and the screw spacing, of course depend on the width of the file. You'll save yourself effort if you oil or grease the work faces that guide the jig.—*Joseph Tracy, Manhattan, N. Y.*

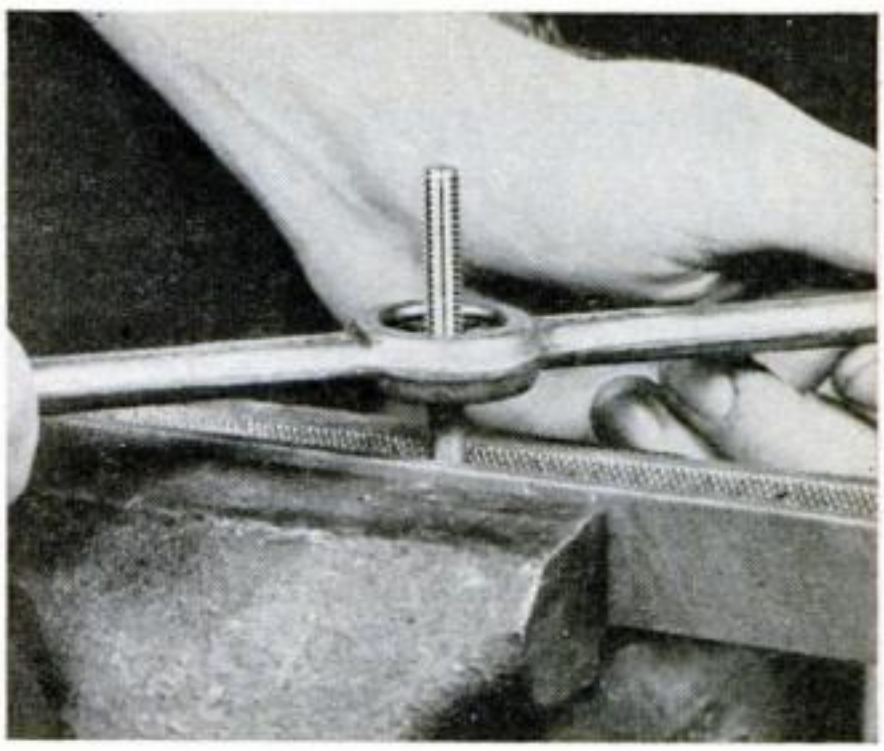
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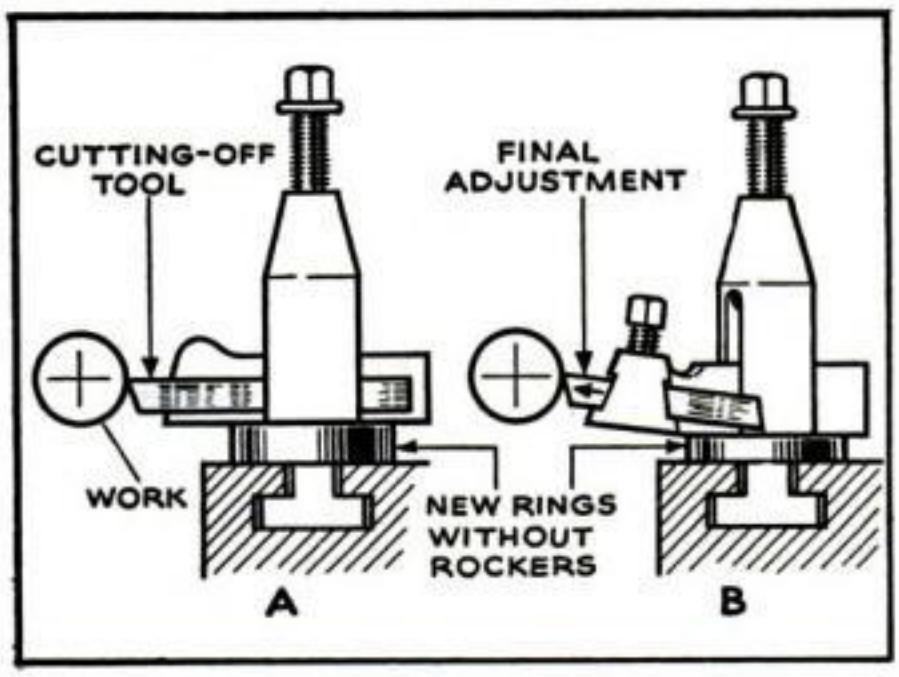
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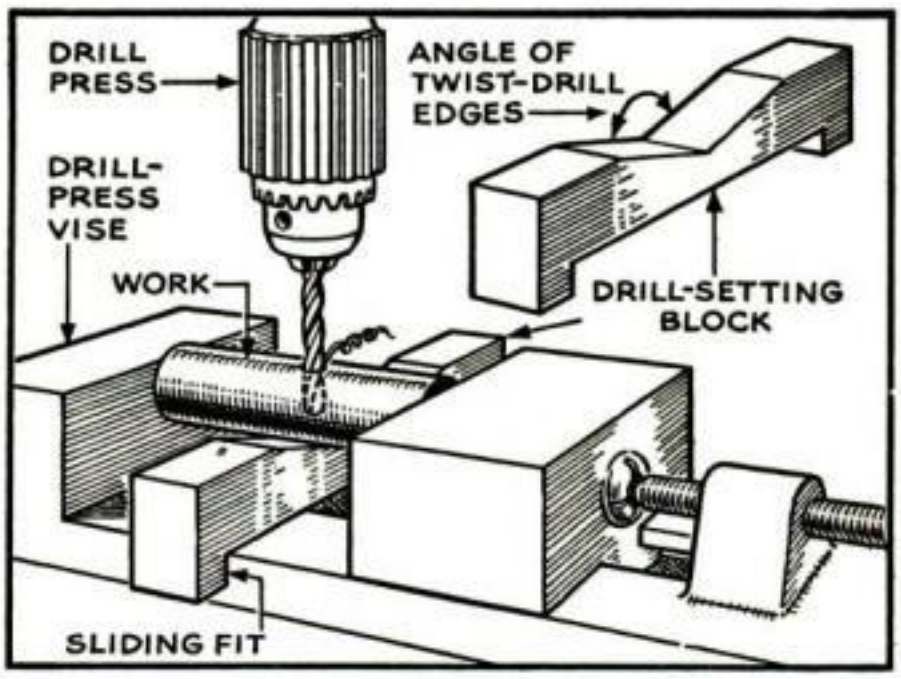
Center Rest Improvised. From a junk-yard casting (part of a Chevrolet truck universal), I made a useful center rest for my lathe. I brazed three nuts 120 deg. apart to the edge of the casting, and drilled and tapped the base for a 5/16″-18 hold-down bolt. A notched hardwood spacer fits the lathe ways. Steel bearing balls ⅜″ in diameter are silver-soldered to the ends of the three 7/16″-14 bolts that support the work.—*Edward Munroe, Schuyler Lake, N. Y.*



Files Help Vise Hold. If vise jaws are worn smooth and no longer grip tightly, try holding work between a pair of old files or rasps, as pictured above. This setup is especially useful when threading, loosening tight nuts, or performing other operations where round stock must be gripped very securely. It's also handy when there's danger that tubing or pipe might be crushed if the vise is tightened hard.—*Don G. Pittwood, Moscow, Idaho.*



Ring Sets Tool Height. I found it tedious to adjust tool holders and rockers to bring lathe cutters to exact center height, so I made some special rings to do the job for me. Using 2″ steel stock, I turned a ring to a thickness that would bring the cut-off tool to the correct level when clamped without a rocker, as at A above. Other rings of different thicknesses can be made to suit other tool holders, as shown at B. In the case of these rings the exact thickness is less critical, since minor adjustments can be made by sliding the bit in or out of the holder to change the height of the cutting edge.—*Allan S. Reid, Valparaiso, Chile.*



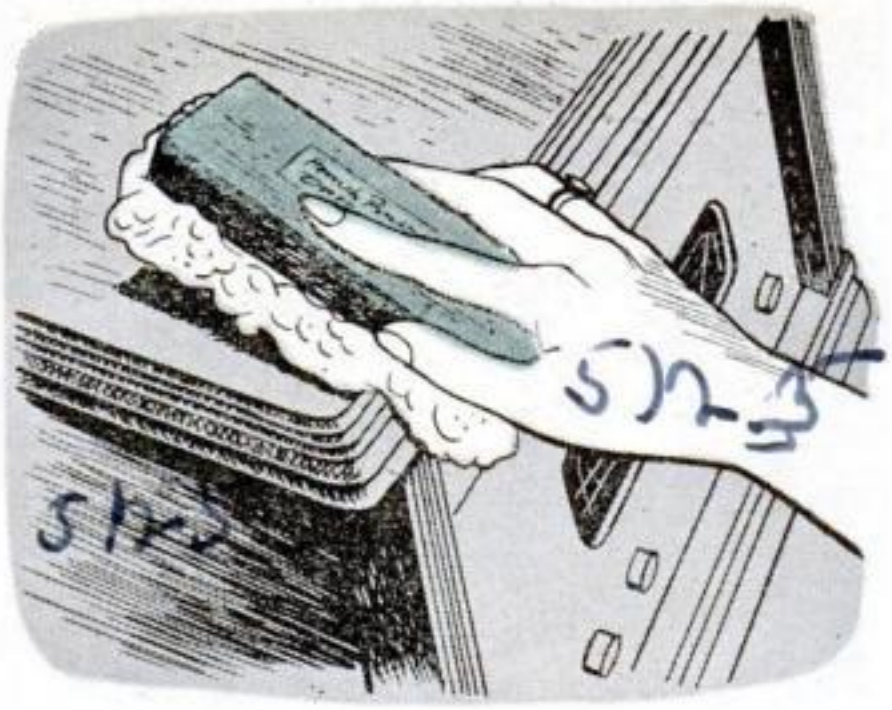
Vise Block Locates Holes. When drilling radial holes in short pieces of round stock, it's difficult to spot the work and drill-press vise accurately. A special V-block made to suit your vise will make the centering job easier. It is a steel block with a central V of the same angle as the twist-drill edges and a pair of lower shoulders that are a sliding fit on the vise sides. To use, place the work between the jaws and locate the vise lengthwise; then remove the work and use the block to locate it transversely; and finally replace the work on the block, clamp the vise down carefully, and start drilling. —*H. Moore, Leeds, England.*

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Keeping the Home Shipshape



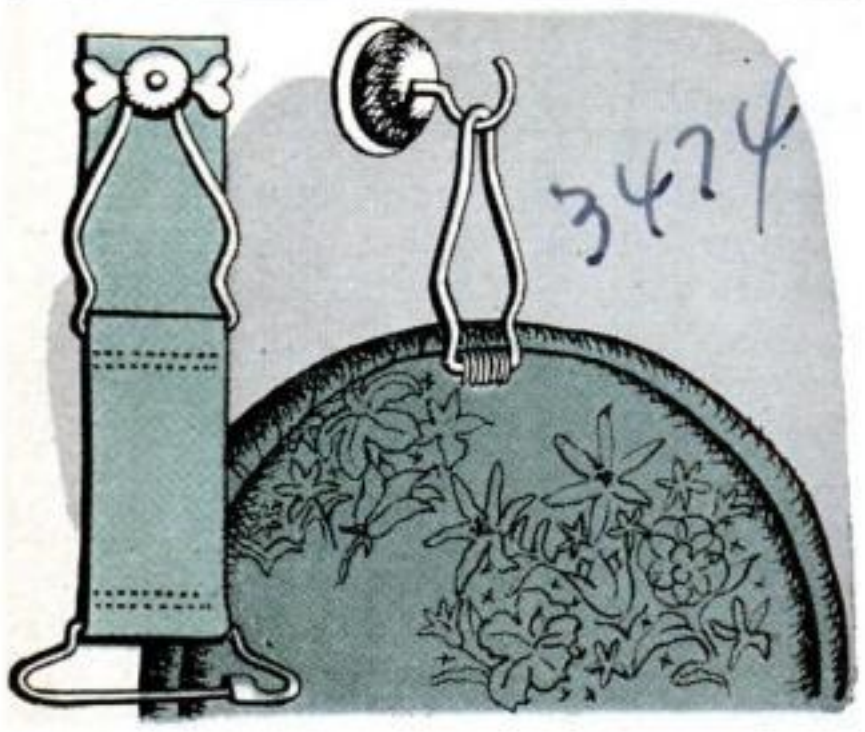
Valances faced with drapery fabrics that can be changed with your curtains will give your color scheme a lift. They are simple to make; molding is held by screws from inside.



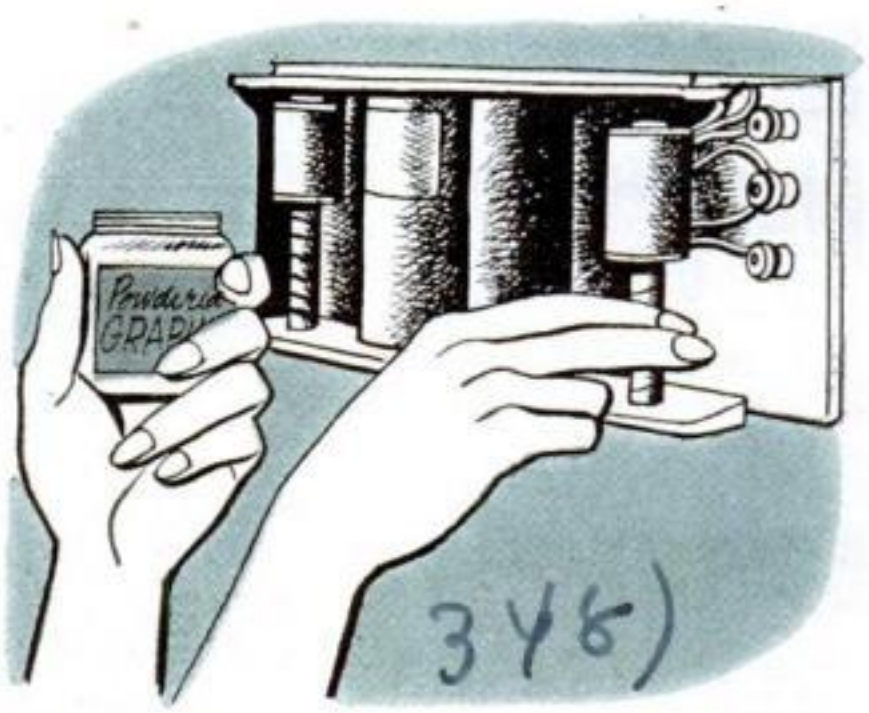
An ordinary shoe buffer—a clean one—is fine for polishing furniture, especially pieces with curves and molding. The soft pad adapts itself to such uneven surfaces.



A sturdy wire coat hanger and several large safety pins will hold a pillow comfortably upright against the back of a bed. Stick the pins through the pillow case and the pillow.



Hang-up hooks for pot holders can be made from metal clasps taken from old garters. Remove the clasp and sew it to an edge of the holder as shown in the drawing above.



Sluggish door chimes that refuse to respond to careful cleaning will often sound better after a little powdered graphite is blown onto the plunger to smooth its way.

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4467



Tooth-powder waste due to excessive flow from large spout openings can be stopped by drilling a ⅛" hole in the cap. Leave the cap on and rotate it to open or close the hole.

6234



Lower cupboard shelves become more accessible when fitted with an extra bottom to which a rear ledge has been butted. Simply pull out the false shelf to get at the contents.

4038



Absent-minded users won't carry the nail clipper out of the bathrom if you attach it to the wall with a chain. Drill the clip for the chain if it doesn't have a hole already.

6089



Do your children jam the type bars and generally gum up your typewriter by banging the keys? To prevent damage, drop a wad of paper on the type when you leave the machine.

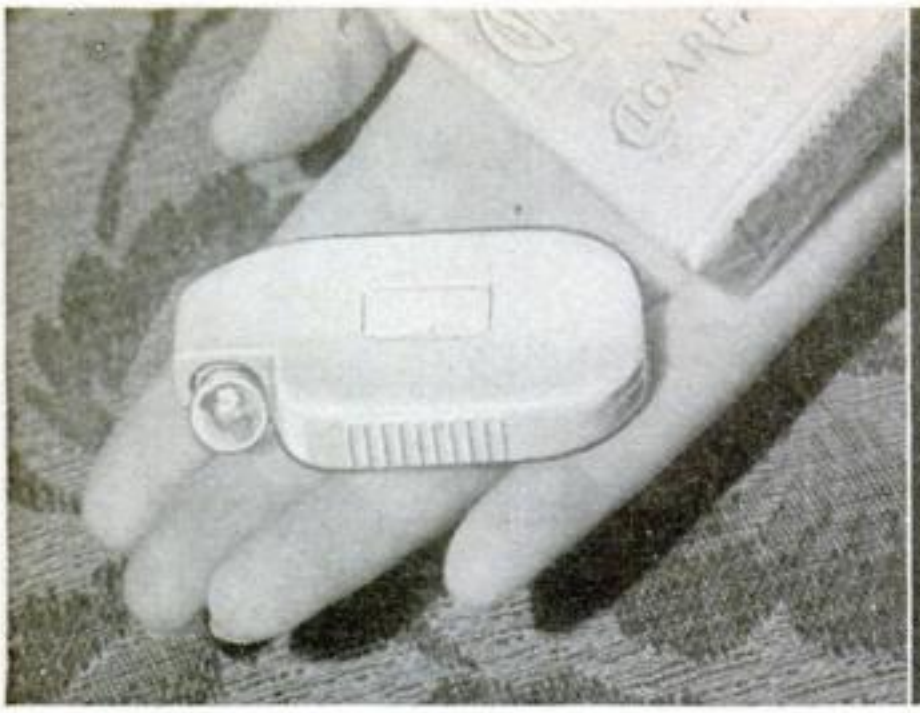


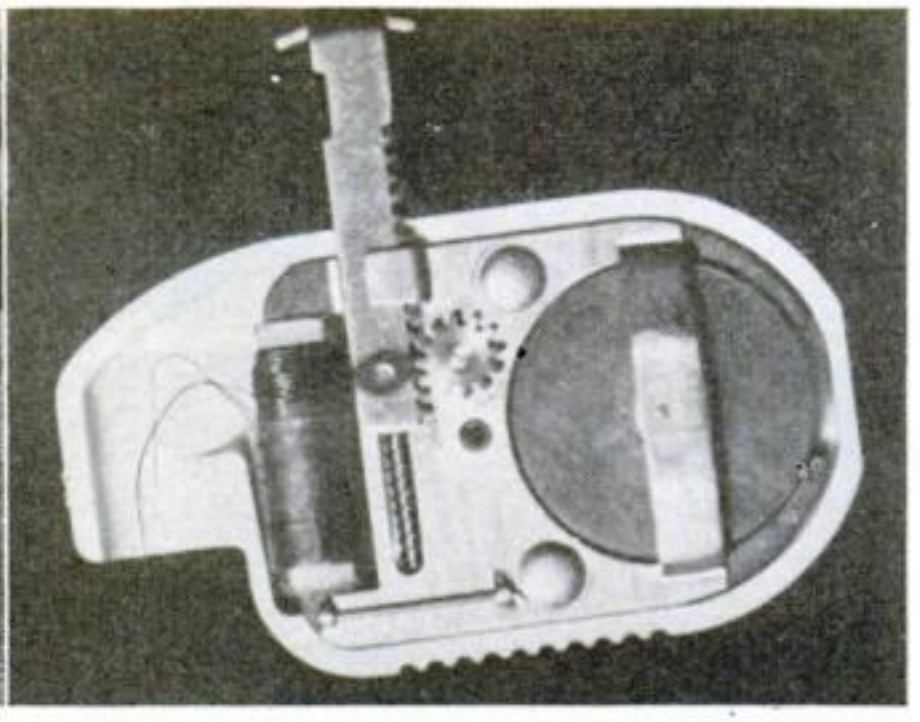
To even up or shorten the legs of a table or chair uniformly, cut a slot in a cardboard mailing tube, slip it over each leg in turn, and use it to scribe a sharp mark or as a saw guide.

6127

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6189





Pocket-Size Flashlight Powered by Tiny Magneto

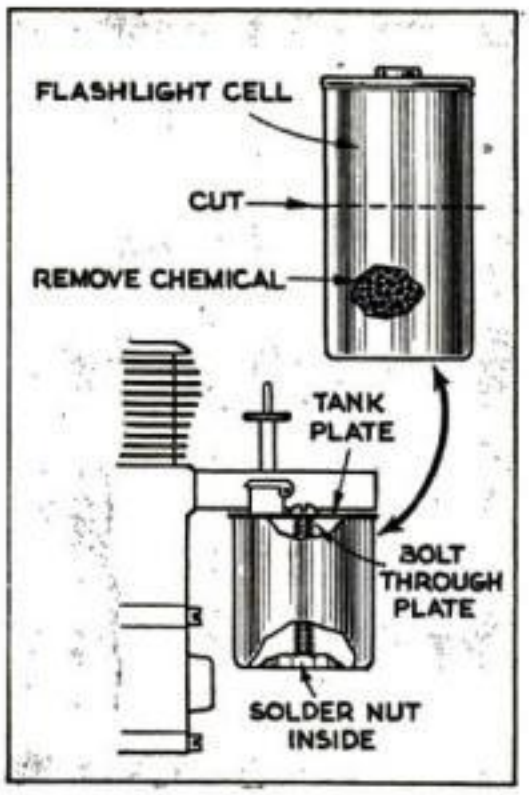
A VEST-POCKET flashlight that operates without batteries has been put on the market by the Jeny Corporation, Merchantville, N. J. Electricity for the bulb is provided as needed by pumping the spring-returned magneto lever. The complete unit weighs about 2½ oz. and its size may be judged from the photo at the upper left. As no lens or focusing device is used, the lamp gives wide-angle illumination.

6201



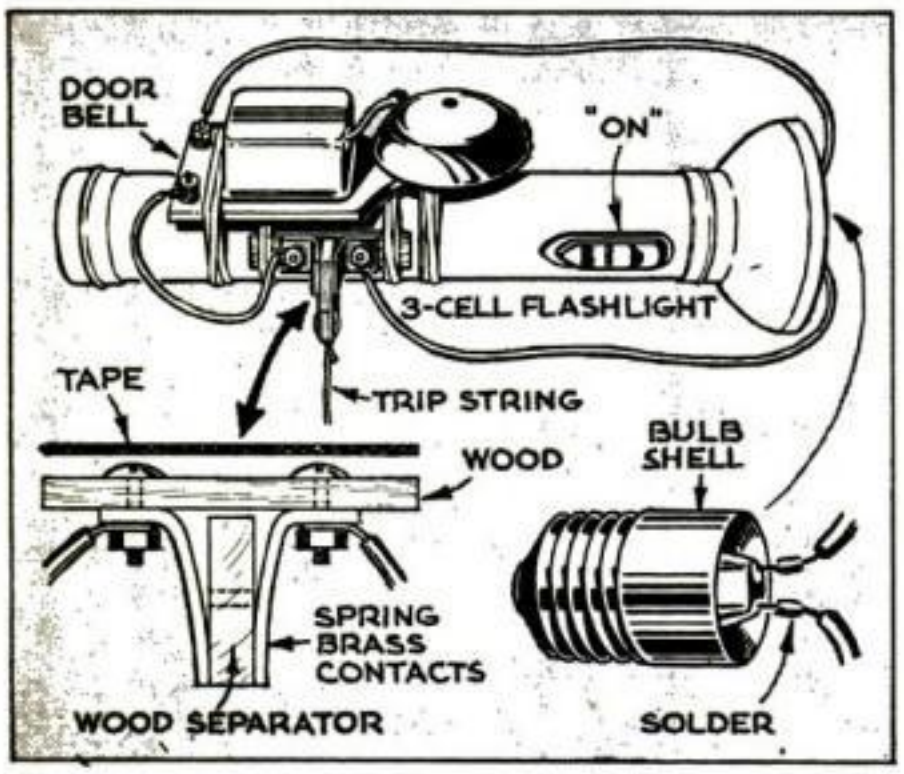
Tank for Glow-Plug Fuel

TO USE a glow-plug ignition system on a conventional model engine, I had to change the fuel tank as well as the fuel, for glow-plug fuels react with plastics. I removed the original tank and improvised a replacement from a discarded flashlight cell by sawing it in half, removing the chemical, and soldering a nut to the bottom. A bolt cut to the correct length secures the tank the the plate. The smaller "C" cell makes a better fit on some engines. *–Don G. Pittwood, Moscow, Idaho.*



Portable Alarm Can Be Used Where You Need it

4077



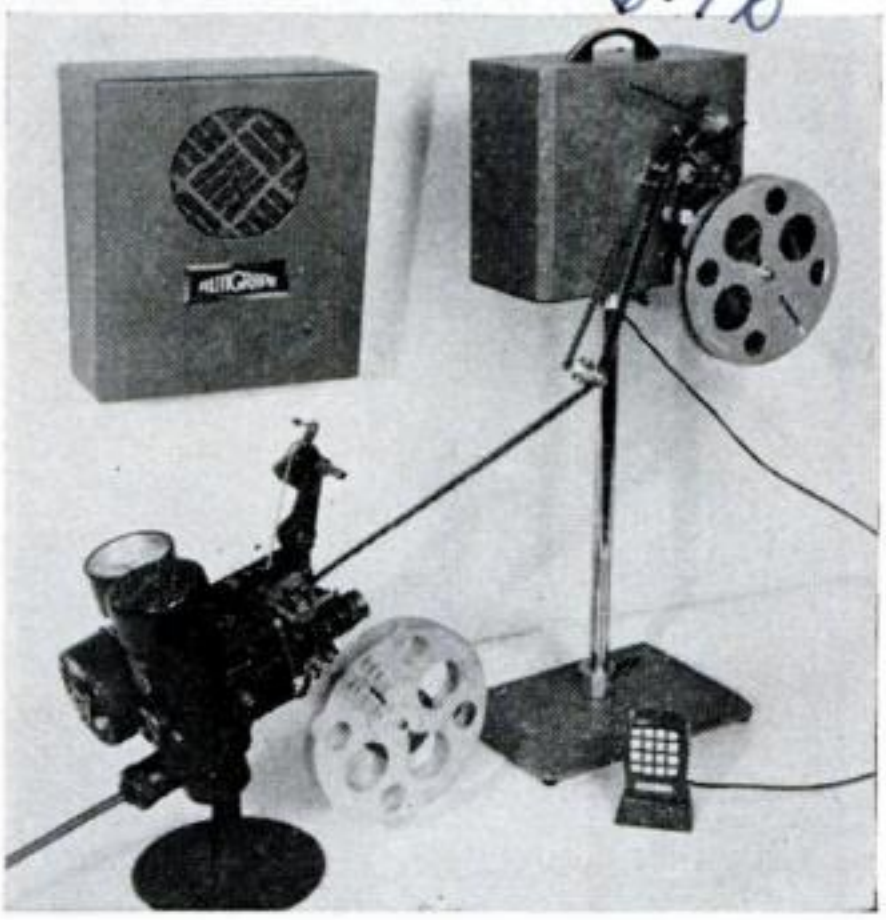
THIS burglar alarm is easily installed or switched from one window or door to another, or used by campers to signal the approach of strangers. It's made of a doorbell and a three-cell flashlight; either can be restored to its original service in a minute. Two spring-brass contacts and the bell are screwed to a piece of wood which is fastened to the flashlight with a rubber band.

Break the glass off a burned-out flashlight bulb and solder a wire to each of the filament supports. Tape the base and screw it into the socket. A wood separator, tacked to the trip string, holds the contacts apart.—*Ken Murray, Colon, Mich.*

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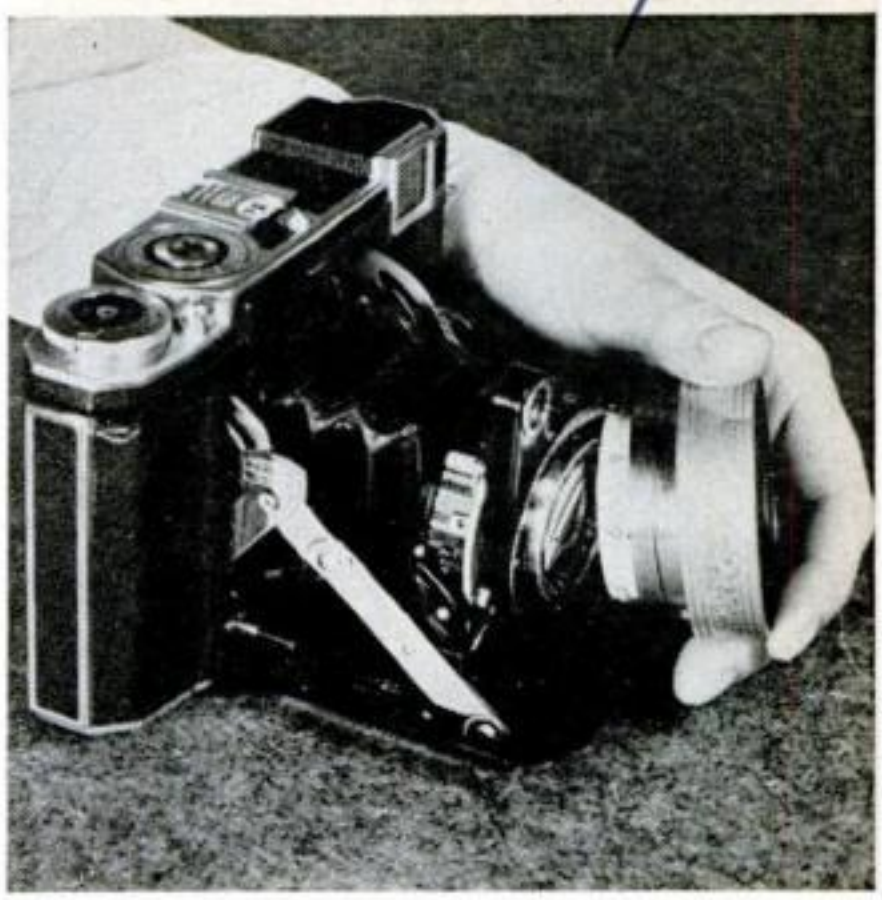
PHOTO IDEAS AND EQUIPMENT

6176



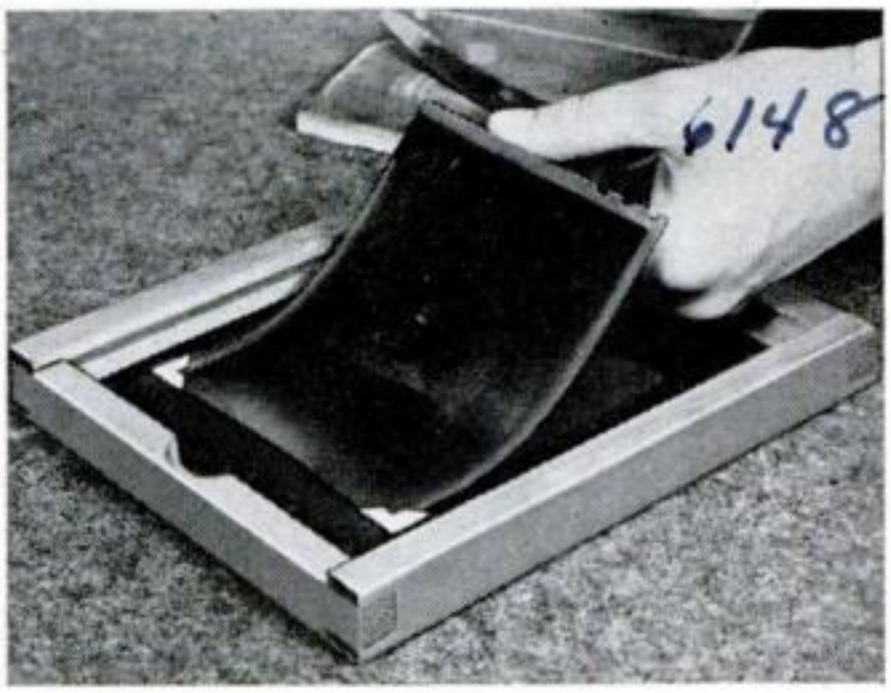
Sound Track Added to Home Movies. No processing is needed to synchronize a sound track directly onto already developed 8- or 16-mm. home movie film with the Filmgraph ®. The machine uses a fine jewel to cut a sound groove .002″ wide on either edge of black-and-white or color film. Played back through the Filmgraph and a standard silent projector, the film then becomes a talkie. A mike and speaker are included in the outfit. The maker is Miles Reproducer, Inc., New York City.

6147



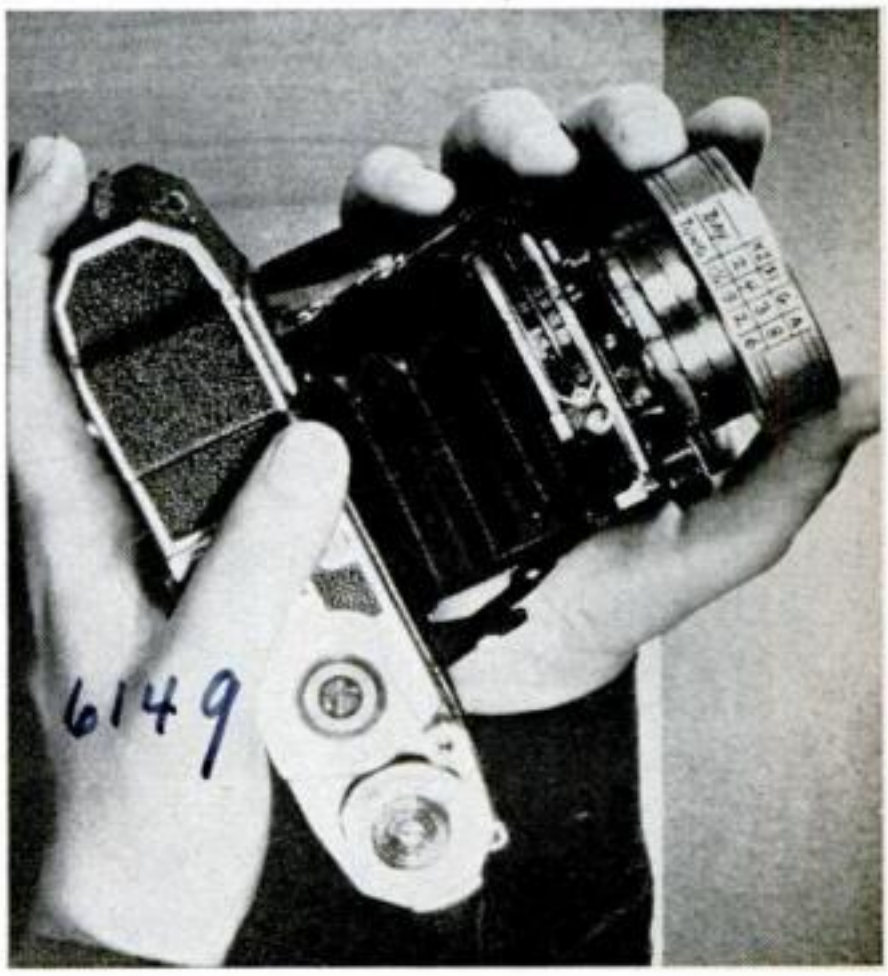
Distance Scale on Lens Shade. With cameras that have the distance scale engraved in the rim of the lens mount, settings cannot be read with a lens shade or filter holder in place. You can easily overcome the inconvenience of having to remove the accessory each time to read the setting. Simply letter duplicate distance scales on narrow paper collars and attach them to the flange of the shade or holder by bands of clear cellulose tape.

6148



Stops Prevent Paper Slipping. To keep paper and negative from slipping out of alignment when the back of the printing frame is put in place, glue two photo-mounting corners to one end of the mask.—*H. W. Moore, Binghamton, N. Y.*

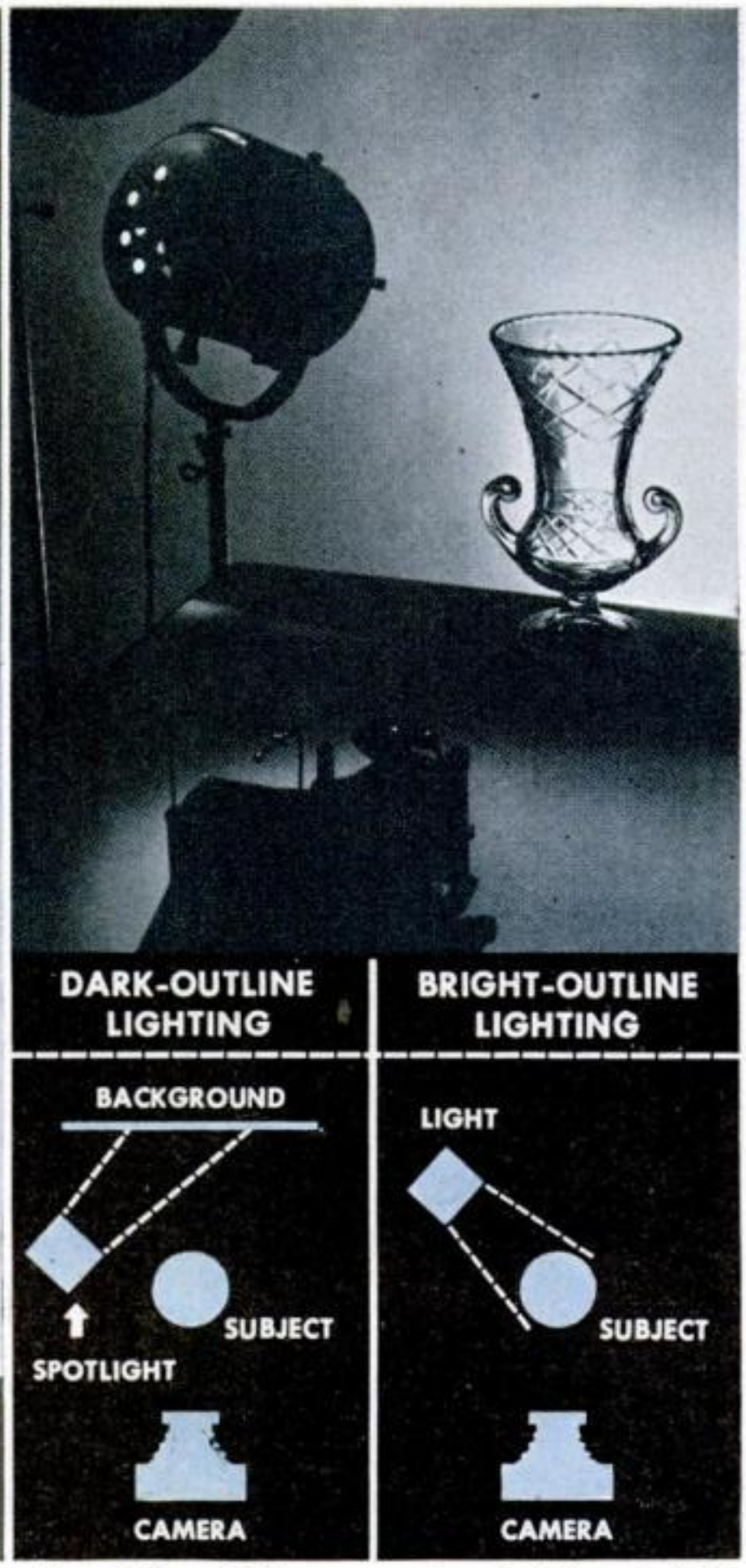
6149



Filter Factors on Lens Shade. You'll always have accurate data handy if you attach a small chart of filter factors to your filter holder or lens shade as shown in the photo. Fasten the chart on with rubber cement or cellulose tape.

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Two lighting setups are basic. Other lights can be added as needed. For the dark-outline shot, left, a 500-watt spot and 150-watt bulb in a reflector were placed as in the top photo.

How to Photograph Glass

Ordinary lighting on glassware means flare, reflections, and headaches. These two special techniques help get rid of the grief.

By Kenneth M. Swezey

HAVE you ever tried to photograph your wife's prized glassware or some plastic masterpiece you've spent hours in fashioning? Did your final prints contain a couple of glaring light reflections, with the object itself practically invisible?

One experience like this is enough to show you can't use lighting methods that are per-

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Backlighting gives realism to this sparkling example of the bright-outline technique. Three lights were used, two behind to the left and right and one in front to lighten the shadows.

fectly suitable for portraits—one light, say, at the camera and another above and to the side.

Why is this so? Because you see colorless, transparent objects—and the camera sees them—by more subtle means than you see opaque, or lightproof, objects. You determine the shape, texture, and tone gradation of an opaque object merely by light reflected from its surface. On the other hand, you observe the characteristics of glass, plastics, and transparent liquids by a complex interplay of light and shadow caused by reflection and refraction.

To do a better job of shooting transparent things, you don't need special—or more—lighting equipment. Usually you can do with less. However, you do need a different approach, an observing eye, and plenty of patience. Practice with the two lighting methods suggested in this article should make the way a lot easier.

The first technique produces a dark outline. It's an effective and dramatic way of showing the form of undecorated glassware and the design on cut and etched glass. The width and relative blackness of the dark line may be varied to suit your taste.

This technique is simple. No light is aimed directly at the object. A single spot, a

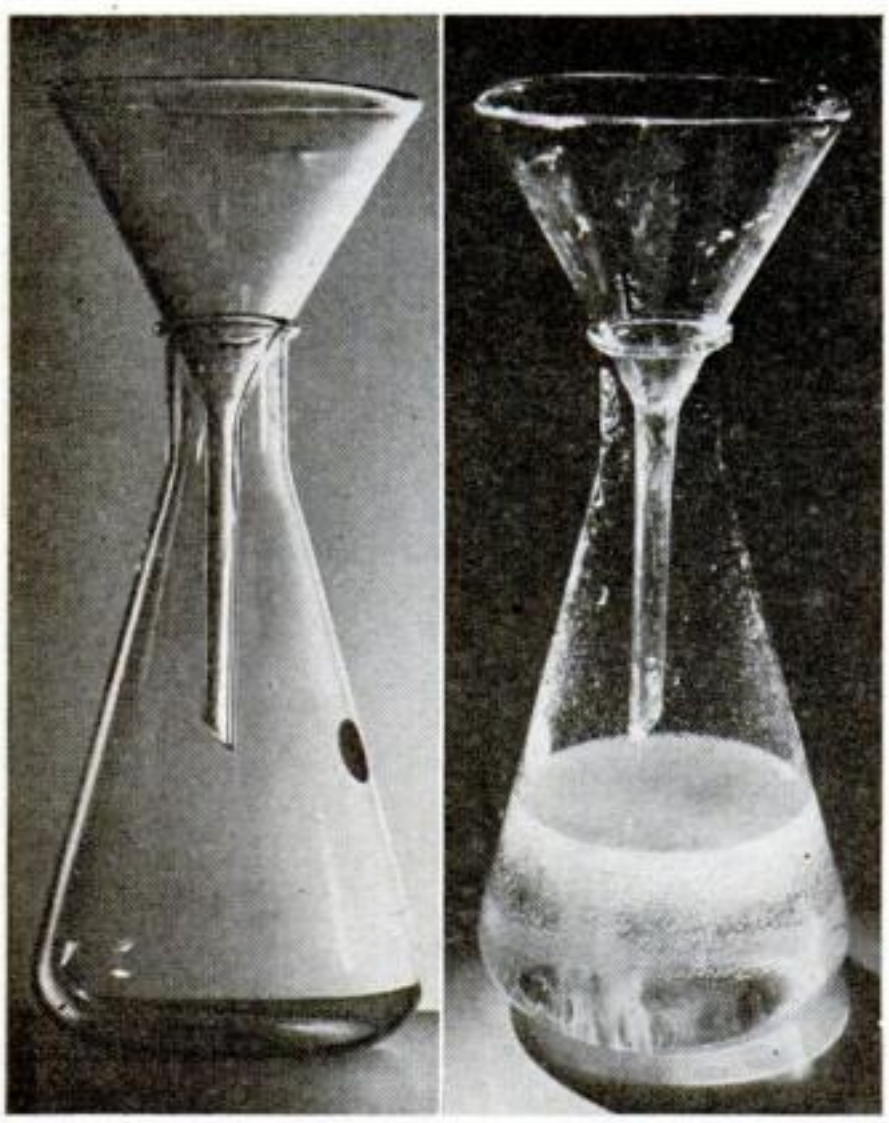
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Chemical glassware is an excellent subject for the dark-line technique. It shows outlines and graduations distinctly. Sometimes you can use it to show changes during chemical reactions.



A 200-watt spot provided the only lighting in this case. It was located above and behind to the left. Notice how the projected shadow and light rings add interest to the picture.



Contrasting examples of the dark (left) and bright-outline lighting methods are seen here. The effect at the left was produced by placing a spot at left side of subject and directing it diagonally against a white background at the extreme right. Backlighting with two spots gave the result at the right. When the subject contains a transparent liquid, as in this case, the bright-outline method is usually better.

flood, or a combination of both is directed at a white background 24″ or 36″ behind the object. You can get endless modifications of the basic dark line by changing the area and intensity of this patch of light by moving it from side to side or up and down.

If you want a thin dark outline, spread the background light over a large area. To broaden the outline, reduce the circle of light. For a softer effect, use a floodlight; for more contrast, a spot. To photograph the vase on the first page of this article, an ordinary 150-watt bulb was placed in a flood reflector and its light superimposed on the light from a 500-watt spotlight. This softened the shadows.

If you want to change the relative width of the dark line on the two sides of the subject, just shift the circle of light sideways on the background.

But here's a point to remember. If the rounded glass you're photographing is solid or filled with a clear liquid, you must move the circle of light in the opposite direction to produce the same dark-line effect you get with empty glassware.

For example, suppose you're photographing a plain glass tumbler. While it's empty, the dark line will be thinnest on the side where the background is most brightly il-

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luminated. But if you fill it with water, the situation is reversed.

The reason? When filled with water, the rounded tumbler refracts light like a lens. The same thing happens with a rounded solid glass object. Photos No. 3 and 4 to the right on this page are examples of this type of lighting. In each case, the circle of light was shifted to the right. In No. 4, notice the light area at the top right where there's no water.

When using the dark-line method you can give glass objects greater roundness by narrowing the background light and placing it a little off center. The illusion of roundness is also increased by shooting from above or below.

A second method of lighting glassware is in sharp contrast to the first. Instead of a dark line, it produces a bright outline. Such lighting often produces more realistic results, but just as dramatic. It depends on light reflected from surfaces and edges.

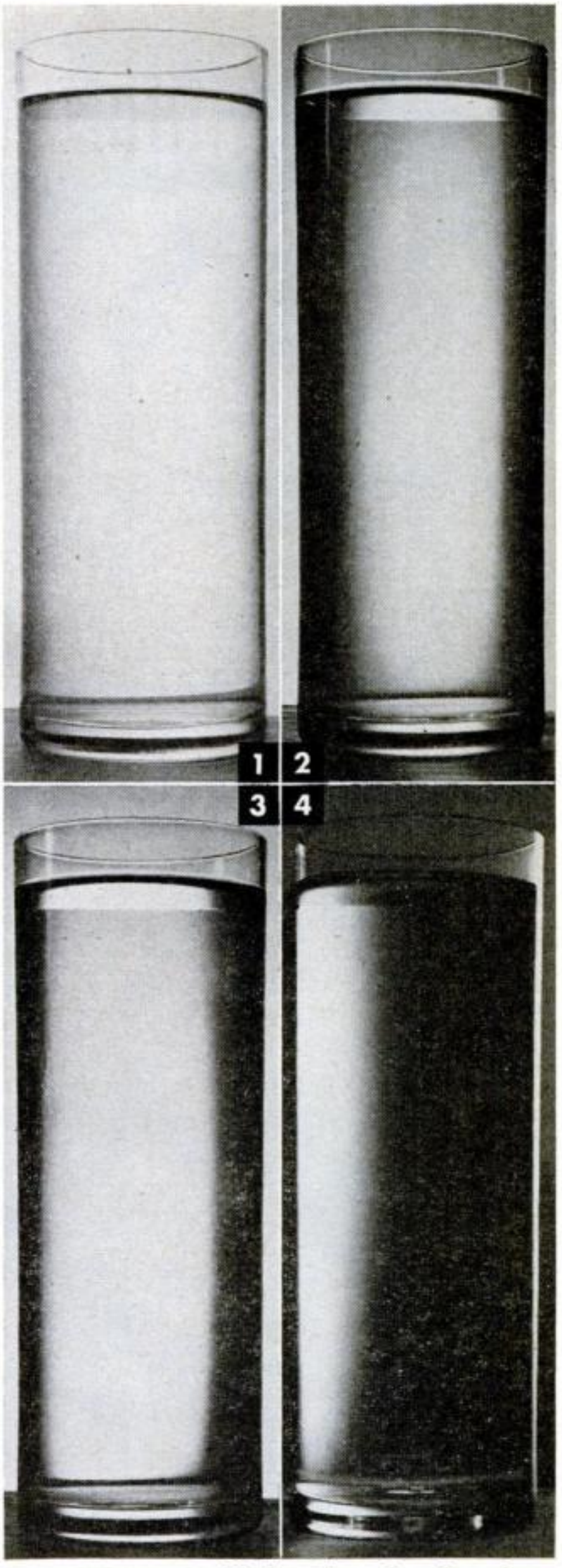
Usually called backlighting, this technique employs a main light directed through the glassware from a position above, behind, and to one side. A spot is preferable for this light. Place it carefully to highlight the top edge and also cast a pleasing shadow pattern through the object onto the table. If other edges or side surfaces of the glass remain invisible, light them with small spots or floods.

The bright-outline technique is especially useful when the glassware contains a transparent liquid. The photograph of the pitcher and two glasses on a preceding page are an example of this type of job.

Three lights were used. The pattern light was a 500-watt spot, behind, above, and to the left. A 200-watt spot slightly behind and to the right outlined the handle. Otherwise it would have blacked out. A 150-watt bulb in a reflector was placed above and in front to lighten the shadows.

The latter emphasizes another good point. When it's necessary to use lights in front of glassware, place them high or low to avoid direct reflection.

Before photographing glass or similar objects by backlighting, be careful to clean them thoroughly. If you don't, every little speck of dust and dirt will show. Wash them in a solution of soapless detergent. Then rinse in clean water and dry with a lintless cloth. Even with this care, specks are apt to remain. These usually can be etched off the negative or spotted on the print. END



Rounded vessels filled with a clear liquid act as lenses, concentrating light from the background when the dark-line method is used. To get a thin dark line (1), a flood was used to spread light over the background. The narrow beam from a spot widened the bands (2) while shifting the spot to one side altered their relative widths (3). Directing the background light far to right gave the effect in No. 4.

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Radio-Building Hints for the Beginner



The best way to learn radio building is by building radios, but these tips may smooth your first steps.

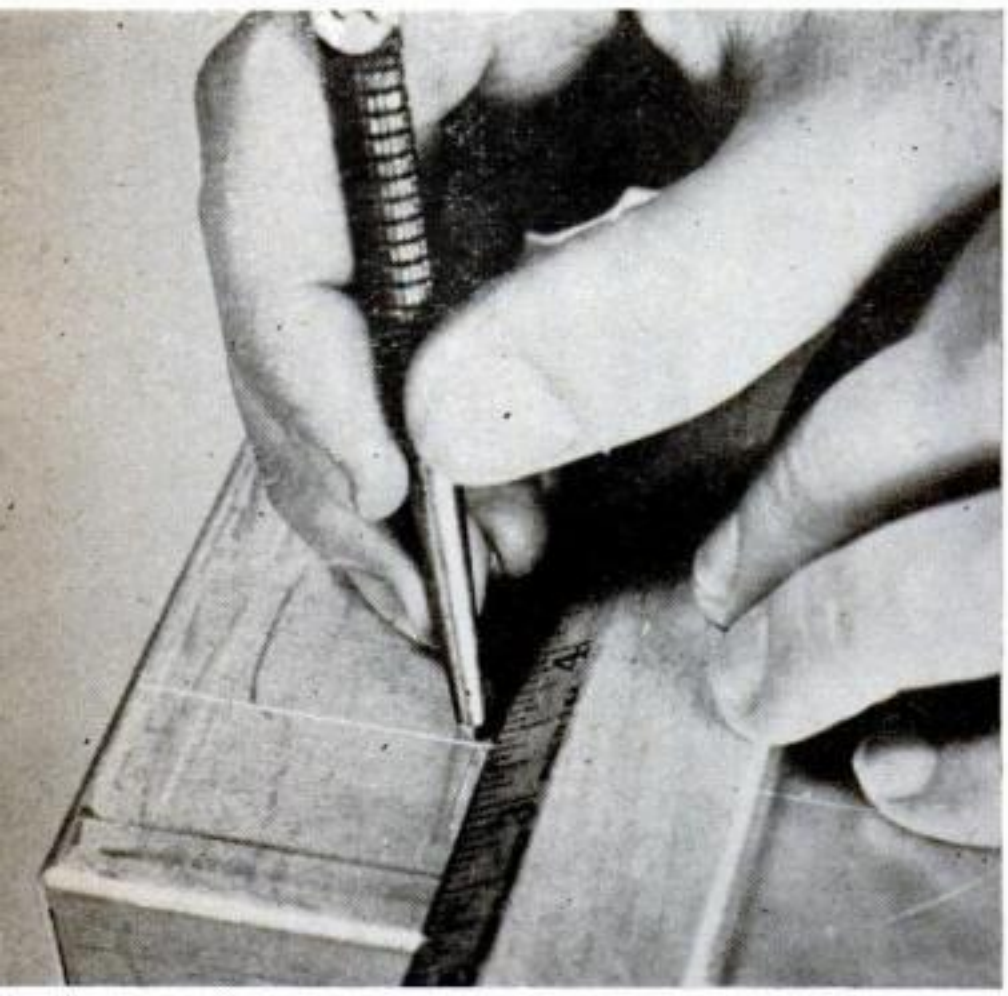
By Frank Tobin

3965

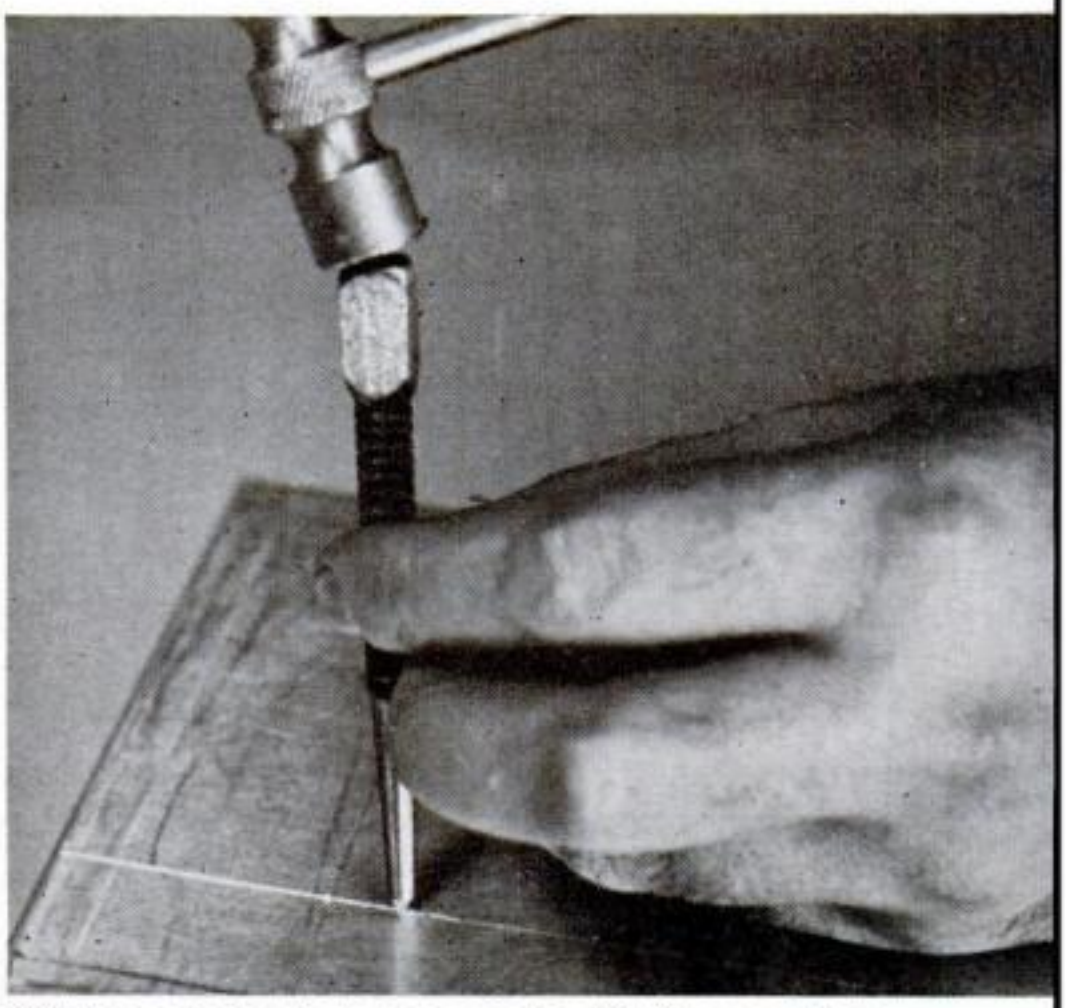
MANY craftsmen who have been bitten by the radio bug have discovered that the hardest thing about getting started in radio is—getting started. Right at the outset you have to answer a hundred practical questions that crop up even in the simplest project. Common sense can answer most of them, but a few pointers may help you past the first bottleneck.

Quite literally, the chassis is the foundation of any electronic gadget. It's the place where you hang all the parts. You can bend it up out of tomato cans, cut it from a breadboard, or use the orthodox kind that you buy in radio stores. Most of the latter are made of either aluminum or steel, generally about 1/16″ thick. They come in a variety of sizes and finishes.

Aluminum, of course, is easier to work with than steel, particularly if you have only



A ruler and a sharp punch are used to mark a chassis. For experimental layouts that may have to be erased, use soft or colored pencil.



Where a hole is to be made, hit the punch a sharp hammer blow. The indentation guides the drill, helps get the hole exactly on center.

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a hand drill. With an electric drill the difference isn't very great. You can use carbon-steel bits with a hand drill, but high-speed drills will last longer if you have a heavy-duty electric drill.

Drilling the holes is an easier matter than deciding *where* to drill them. Tube sockets and coils especially must never be placed haphazardly. They have to be located and oriented so as to keep the leads as short as possible. Not all wires can be short, of course, but they aren't all equally important. The critical ones are those going to plates and grids. From the diagram or a tube manual you can easily figure which way to turn a socket or IF transformer so that the leads will remain short. Screen-grid and B-plus wires are next in importance. Keep them short if you can, but don't worry if they have to stretch a bit. Heater, ground, and AVC leads practically don't count in the shortness sweepstakes.

Should you find that the grid leads in an audio or output stage have to be long, use shielded wire and ground the braid to the chassis at some point. Good examples are the connections to volume or tone controls. Do not use shielded wire in radio-frequency stages, as the added capacity of the shield may easily throw off the alignment of the coils and tuning condenser. And if any grid wire has to cross one that goes to a plate, make sure they do so at right angles.

Wherever possible, group components which perform similar functions. The RF and IF parts can go on one section of a chassis, the audio and output stages are gathered in another, and the rectifier and power-supply pieces occupy still a different corner.

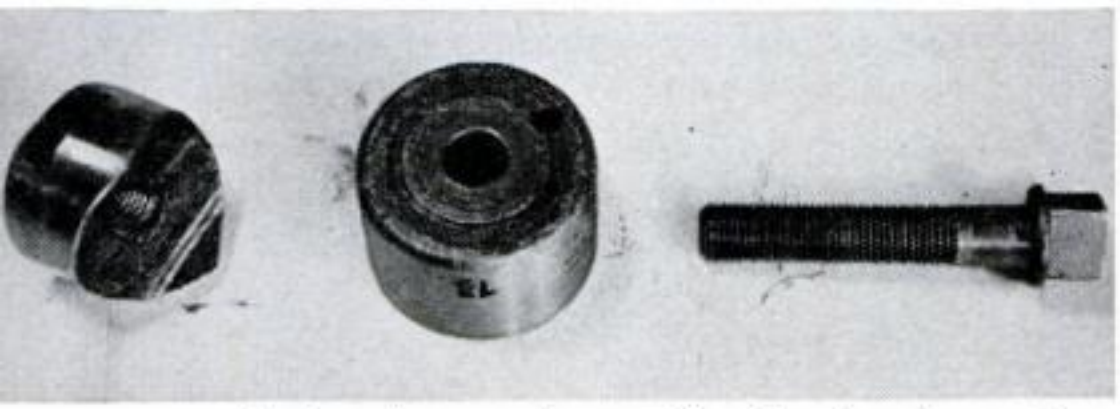
Once you've decided where each of the parts is to go, mark the chassis for drilling with a soft pencil or a sharp-pointed tool. At the spot where a hole is to be drilled, make a punch mark that can serve as a pilot for the drill. Since the three holes for a tube socket (two hold-down screws and that for the socket opening) must line up exactly, marking and drilling require care.

Small holes are easy. All you have to do is select a drill of the proper size. Larger ones for tube sockets and the like are another matter. There are three common methods for making such holes.

You can either enlarge a smaller opening with a rat-tail file, use an adjustable hole cutter in a drill press, or employ a chassis punch. Punches are made in all the common socket sizes; the three that take care of most work are ⅞", 1 1/16" and 1¼".

It is difficult to visualize in advance all the holes that may be needed, but drilling others after some parts are mounted may endanger those parts. Why not drill a few extra holes, especially in strategic locations?

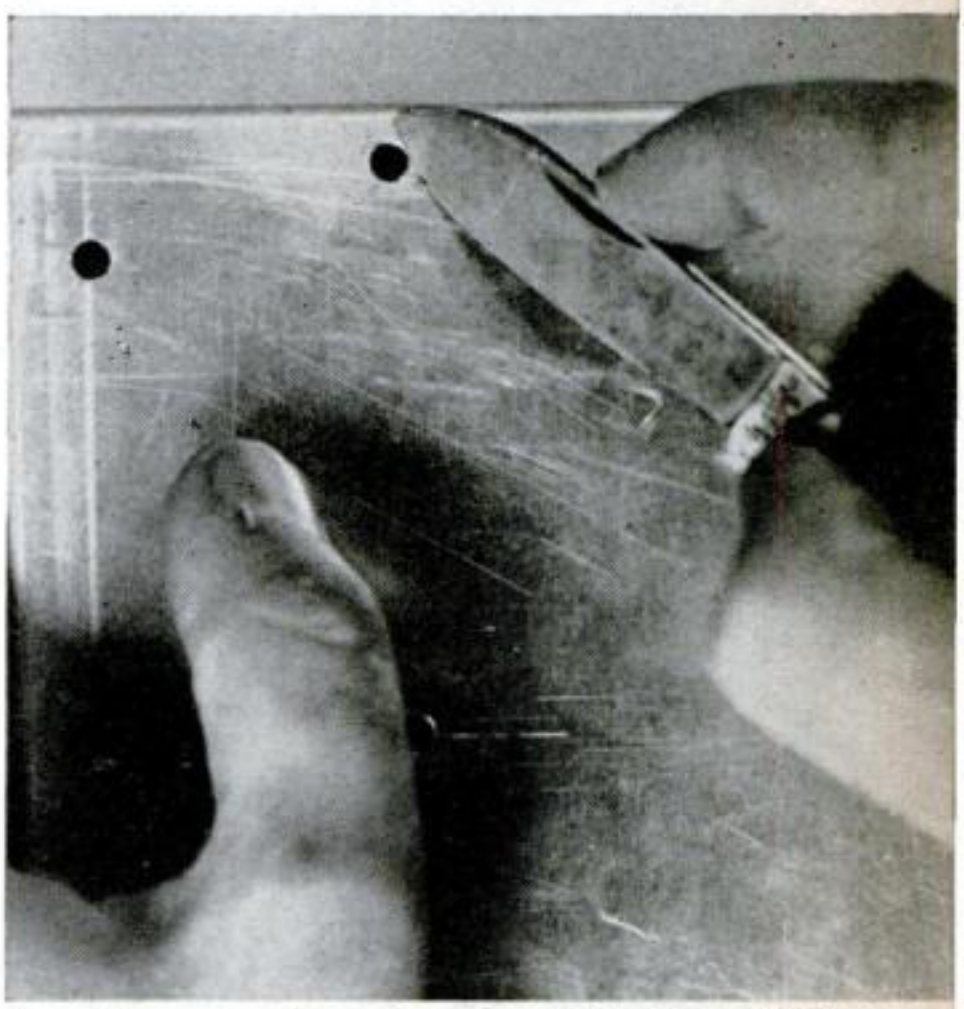
Remember, for example, that leads from



A chassis punch consists of a two-jaw cutter, left, a die, and a machine bolt. A separate punch is needed for each different hole size.



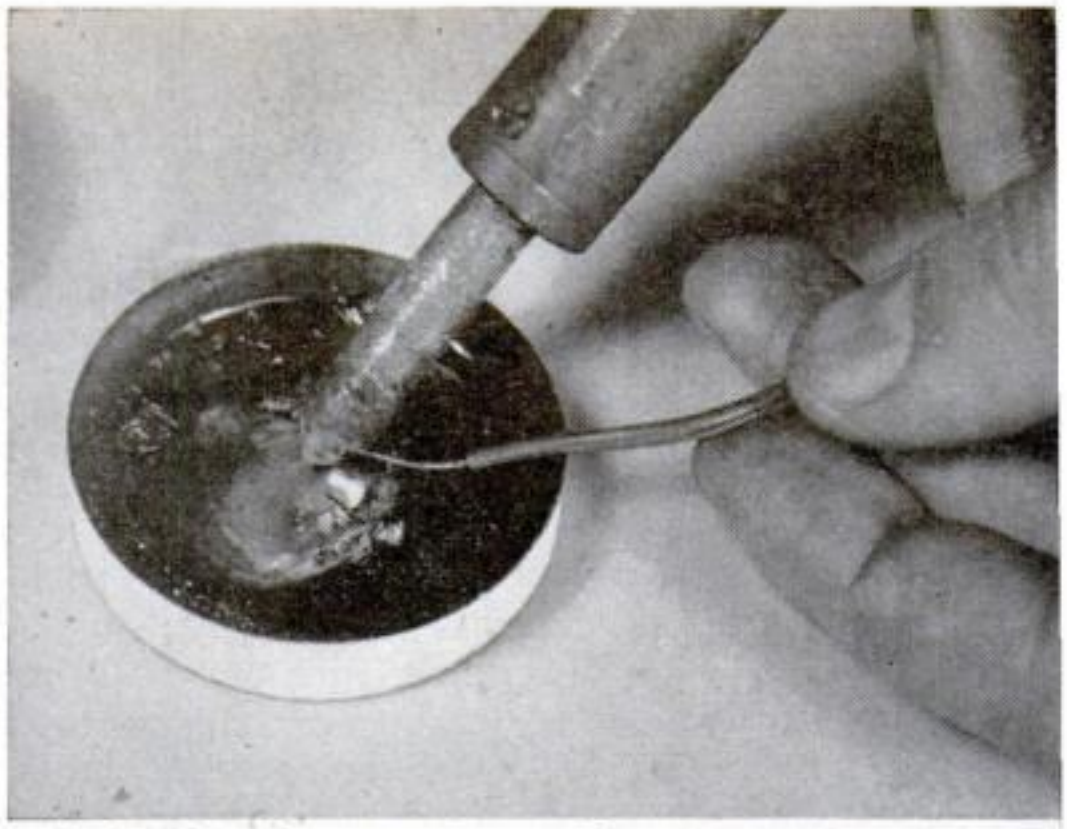
Drawing up the bolt with a wrench brings the cutter and die in contact with the chassis and shears out a clean, precise socket opening.



Any burred edges that are left after drilling —especially in aluminum—should be removed with a file or a heavy knife blade.

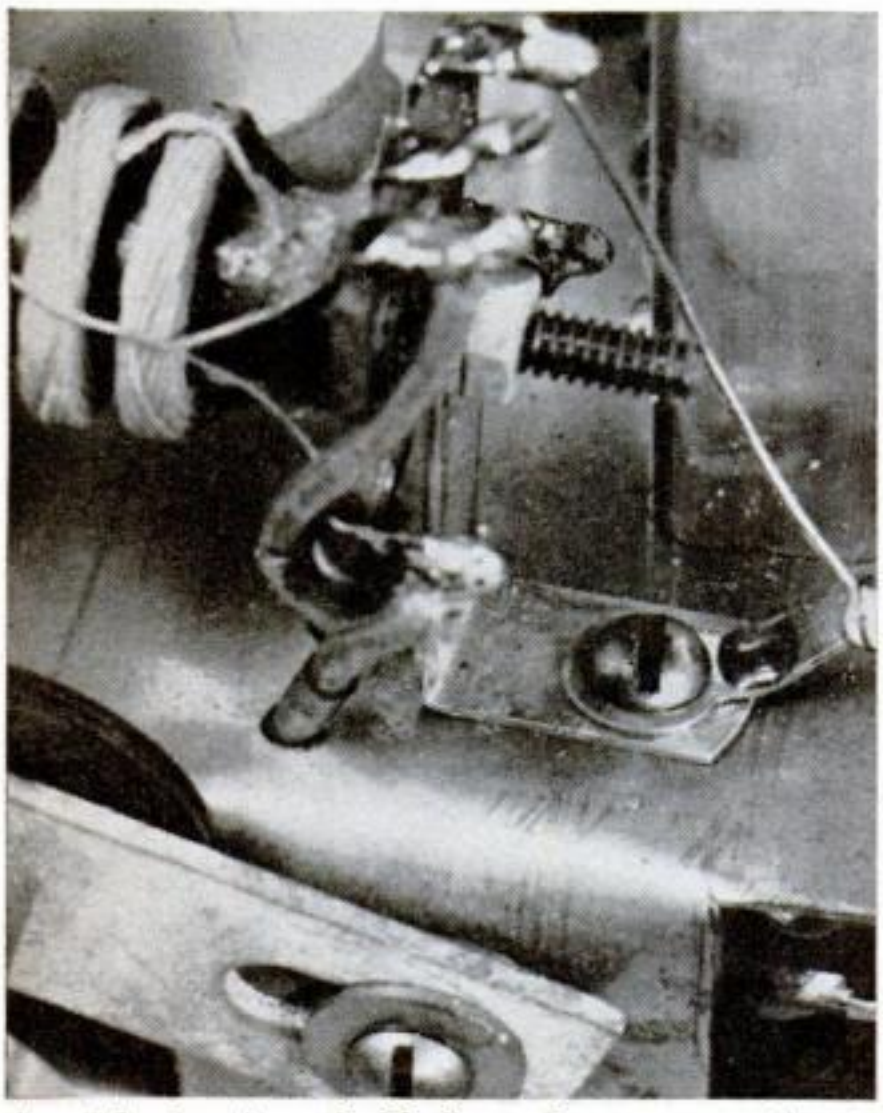
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Copper wire solders best when it is tinned. Best bet is to buy it that way, but you can tin the ends yourself by scraping them clean and dipping them into rosin flux paste. Put an end on a metal plate and run a thin coat of solder over it. Melt off any excess.

a transformer or choke can't get to the underside of a chassis through solid metal. A 5/32" or 3/16" hole is about right for passing a wire through the chassis. You need an opening, also, when you use a tube that has a grid connection brought to a metal cap on top. And for each gang of a tuning condenser there has to be some way to get to the stator (fixed) plate terminals. If the condenser has lugs on the bottom, drill oversize holes—say ½" to ⅝"—so that neither the lug nor the connecting wire can touch the chassis.



A soldering lug, held down by a screw that is used to fasten some other part to the chassis, provides an excellent ground connection.

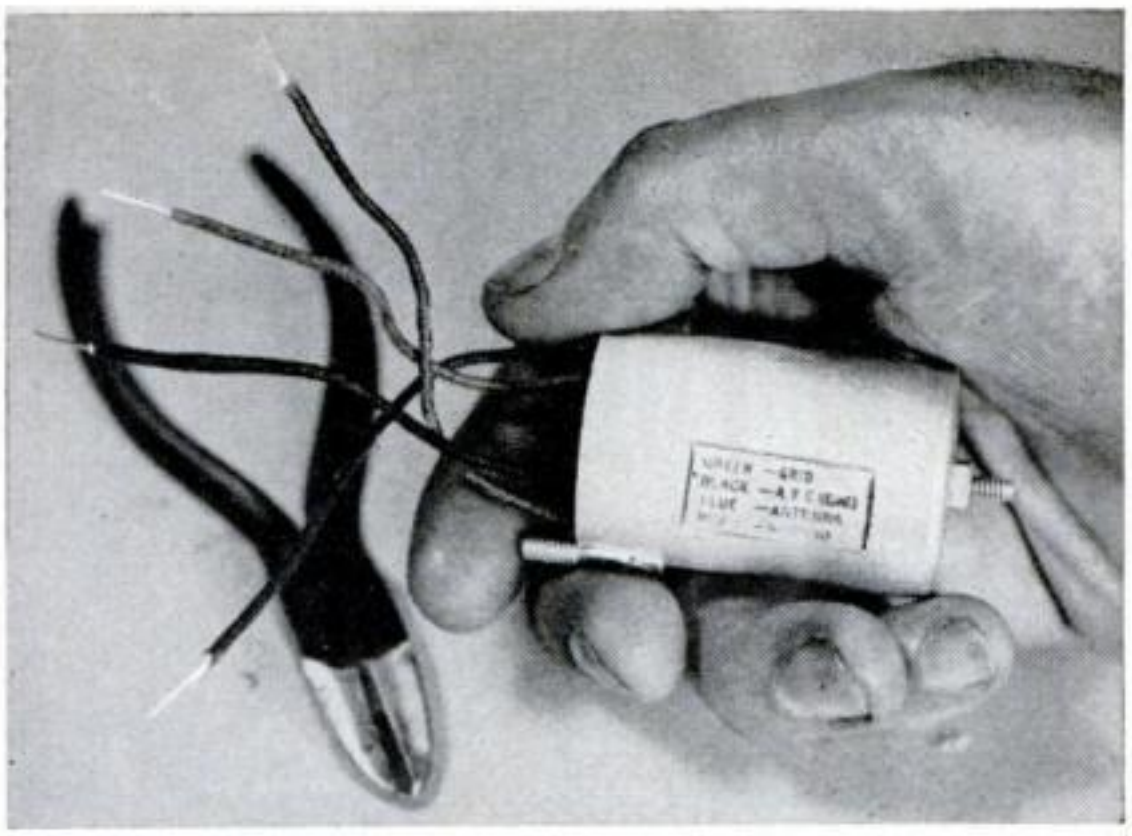
Once you have all the holes drilled and the parts mounted, you can get down to the serious business of wiring the set. It is usually advisable to make all filament or heater connection first. Take care of the cathodes next, then go back to the RF stage and work along, in order, to the rectifier.

In AC receivers where heater voltage is obtained from a filament winding on the power transformer, twist the leads and ground the centertap of the winding. This helps to reduce hum pickup. If the winding has no centertap, ground one of its two leads and one of the heater pins on each tube socket directly to the chassis. The other transformer lead then goes to the remaining heater prongs. Always use stranded wire with good insulation; it withstands twisting and bending a good deal better than solid wire.

While stranded wire is recommended for heater connections, a solid wire—preferably with insulation of the "push-back" type—has advantages for B-plus and plate leads. Being less flexible, this wire can be bent up out of the way and will stay where it is put.

In actual practice you will find that you don't need very much wire to hook up a set. Many components are sold with their own leads, which are almost always ample for the connections that have to be made. If they aren't, the chances are that something is wrong with the placement of the parts. Most often it will be necessary to cut these

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Many components can be purchased with tinned wire leads, all ready to solder into the set. Push about ⅜" of insulation back from end.

leads down to size. When one isn't needed at all, cut it off short.

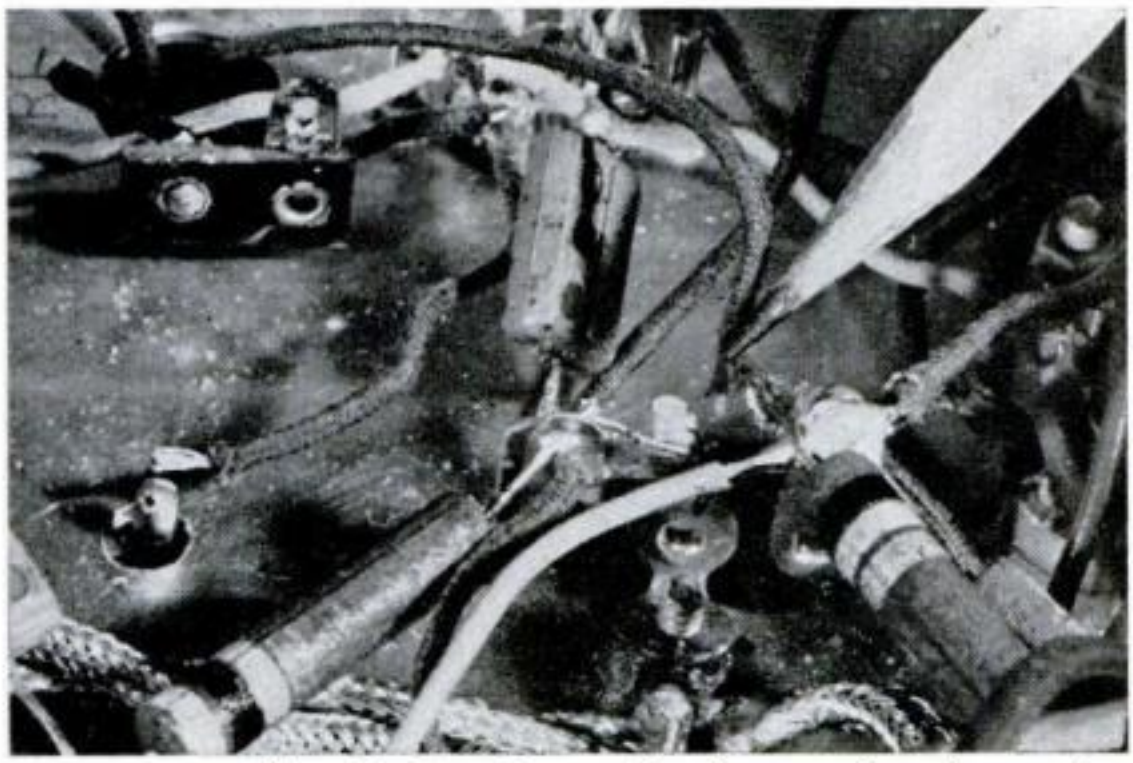
Much the same facts apply to small parts such as resistors, mica and paper condensers, and plate chokes. These usually come with "pigtail" leads which are stiff enough to support their weight. If a pigtail lead has to come near or cross a bare wire, or is in any other danger of grounding or shorting, slip a length of "spaghetti" tubing over it for insulation.

To provide anchoring points for a wire that goes to ground or for two or more leads that come together, use soldering lugs and terminal strips. The soldering lug is a little metal tab with a hole at each end. Slip one hole over a machine screw that is being used to hold down some large part, and clamp it with an extra nut. Wires that are soldered to the other hole will then be in good electrical contact with the chassis.

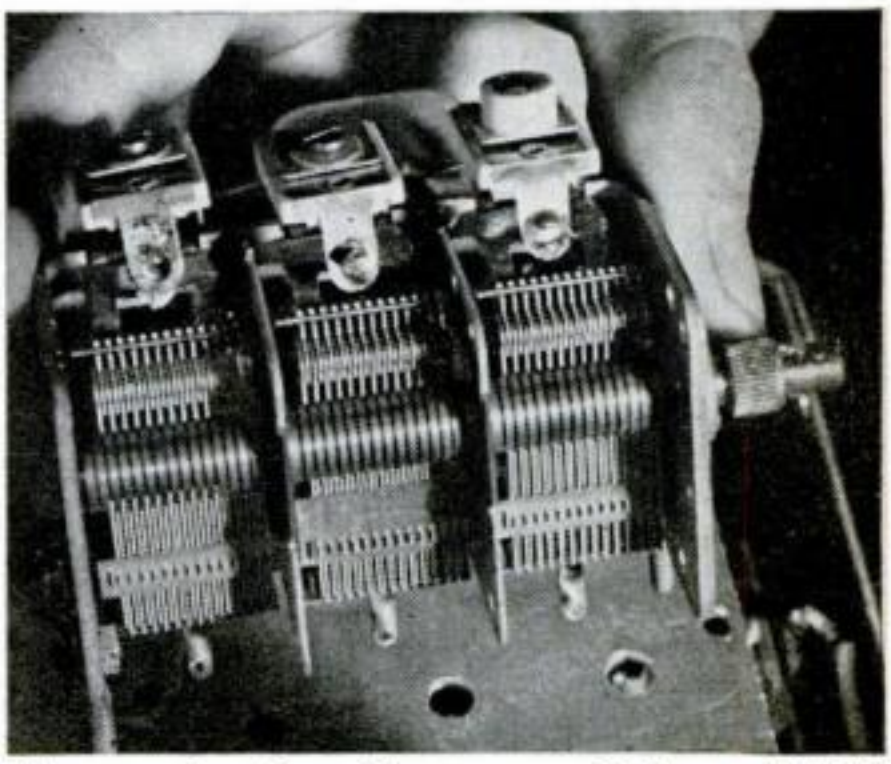
When joining unground wires—as several B-plus connections that come together—use a terminal strip or lug. These consist of one or more eyelets mounted on a fiber strip. A leg is provided for bolting the strip to the chassis, but the eyelets to which connections are made are insulated from all other points.

Copper wire that has been "tinned" (that is, cleaned and finely coated with solder) is best for radio work as it allows faster and more secure soldering. Try to buy tinned wire and parts with tinned leads, but if you can't, here's how to fix them up yourself. Cut off or push back the insulation to a distance of about ⅜" from the end, and clean the copper with a piece of emery cloth. Stick the cleaned tip into a can of rosin flux paste and place it on a small metal plate. Bring a hot iron and a strip of solder into contact with the end. A thin coat should adhere to the wire. Run off any excess with the hot iron.

Never use acid-core solder in radio work. Acid can corrode the connections, and if any should remain between socket prongs or other critical points, it could act as a leakage path for the busy electrons. Plain and rosin-core solders are fine, and a can of rosin paste is handy since even the cored solders can stand some extra flux. Excess paste on a joint need not be wiped off as it can't do any harm. In making soldered connections, heat the joint and let the *joint* melt the solder. END



Terminal strips make fine anchored meeting points for ungrounded wires. The pencil points to one; another one is in the background.

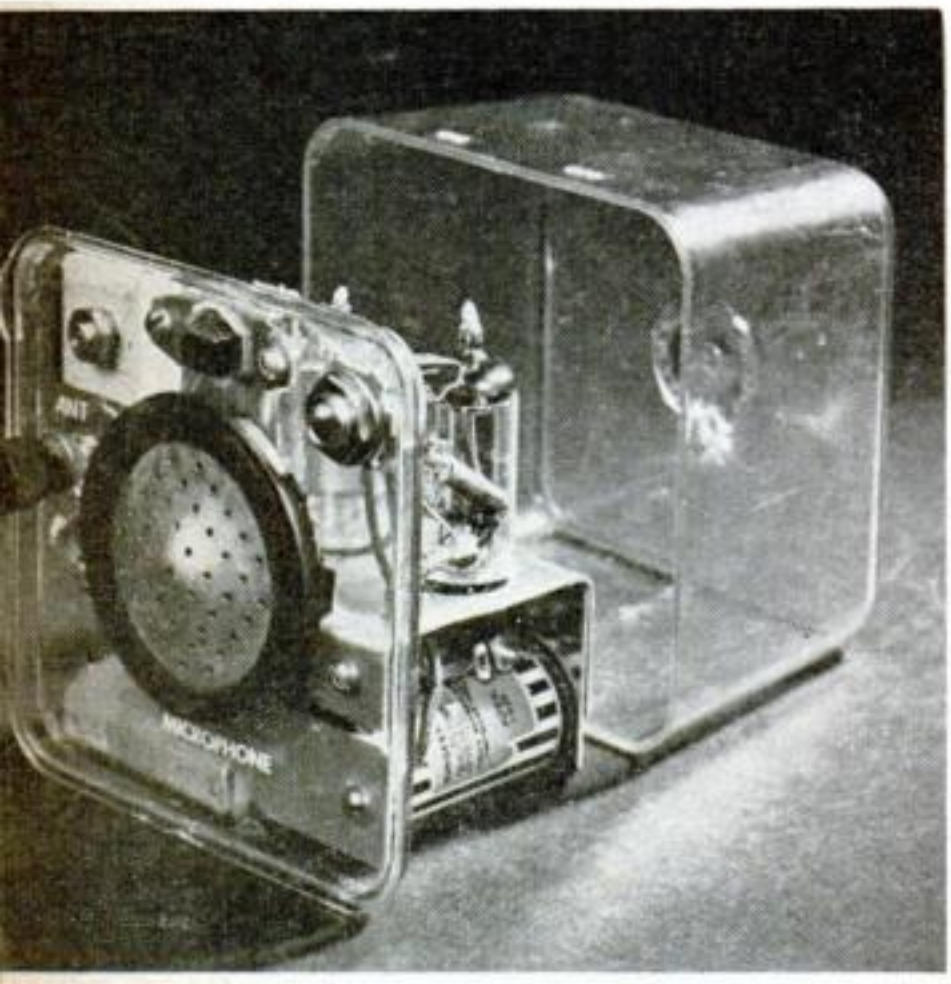


Try to visualize all necessary holes and drill them in advance. One is needed to clear the stator lug on each unit of a ganged condenser.

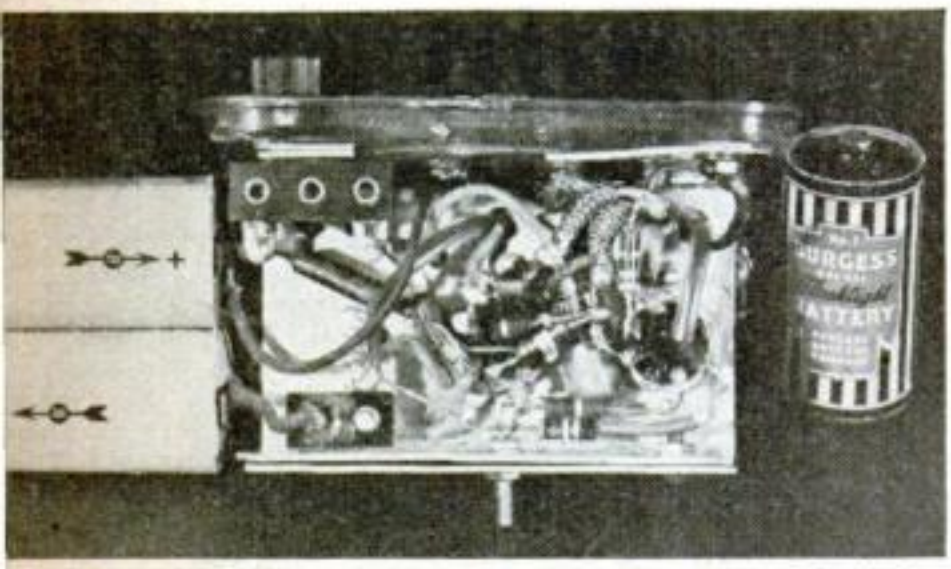
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This complete miniature broadcasting station will fit comfortably in the palm of your hand.



The cartridge from a crystal mike, with the rubber cushion left on, is set into the panel.



Wiring shouldn't be difficult. Just don't let it spread out. Batteries fit under the chassis.

Wireless Mike Puts You on the Air

5304

TALK into this tiny handful of radio transmitter, and your voice will come out of the nearest radio. It can be tuned to any quiet spot near the high end of the band. When held a few feet away from a receiver, this wireless microphone works without an antenna. For greater distance a hank of wire is needed to radiate the signal. If you arrange it right, your party guests don't even have to know that the voice-and-music program that's coming over your radio originates in the next room.

The complete miniature broadcasting station, including batteries, is housed in a tapered plastic refrigerator box measuring 2″ deep and 4″ square across the front. On the lid of the box, which becomes the front panel, are mounted the crystal unit taken from an inexpensive microphone, an on-off switch, a closed-circuit phono jack, an antenna binding post, and a ceramic trimmer. The latter is used to tune to the best frequency between about 1,200 and 1,600 kc. A chassis cut from 1/16″ aluminum to the size and shape shown in the drawing holds the remainder of the parts. It is bolted to the back of the same panel.

There is nothing difficult about the wiring, but this is a miniature circuit and calls for a little extra care to keep the parts from getting in their own way. Use tiny resistors —the ¼-watt type is husky enough—and the smallest paper and mica condensers.

For the A battery, a flashlight cell intermediate in size between the regular and penlight (type C) is used. It measures just under 2″ long and so can be clipped into place between the rear leg of the chassis (which acts as the negative terminal) and a separate tab of aluminum bolted to the front panel. The B-voltage supply is obtained

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from two 22½-volt hearing-aid batteries wired in series. Taped together, these fit the space alongside the A cell. A 45-, 67½-, or 90-volt B battery could be used for greater economy and increased output but it will not fit inside the case. By clipping rather than soldering the B-supply leads, you can easily arrange to switch from the miniature to the larger batteries, depending upon the conditions of use.

As can be seen in the bottom-view photo at the lower left on the facing page, two terminal strips are used as meeting points for some of the connecting wires. By bolting these to the chassis as shown—opposite each other and at the same height—they can be made into a convenient shelf or ledge for the B batteries.

Since the output of a crystal pickup is considerably greater than that of a microphone, only one stage of amplification is used to broadcast records. The pickup jack by-passes the mike preamplifier (1U4 or 1T4) and is coupled directly to the grid of the oscillator-RF amplifier tube (1R5) through a .005-mfd. condenser (C2). As a precaution against overloading this tube, reduce the output of the pickup by wiring



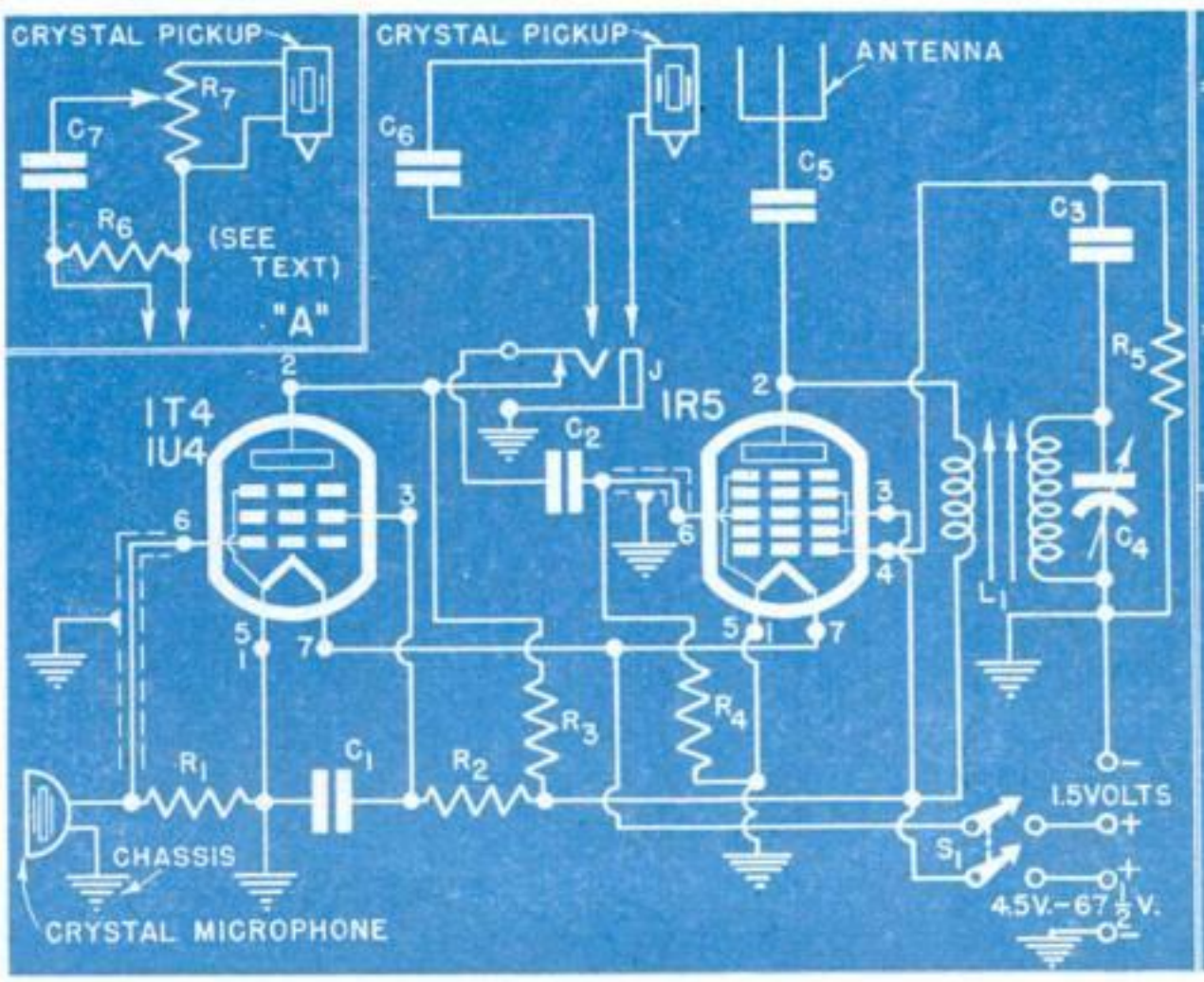
The plastic cover (removed in this view) is held to the chassis by the protruding screw.

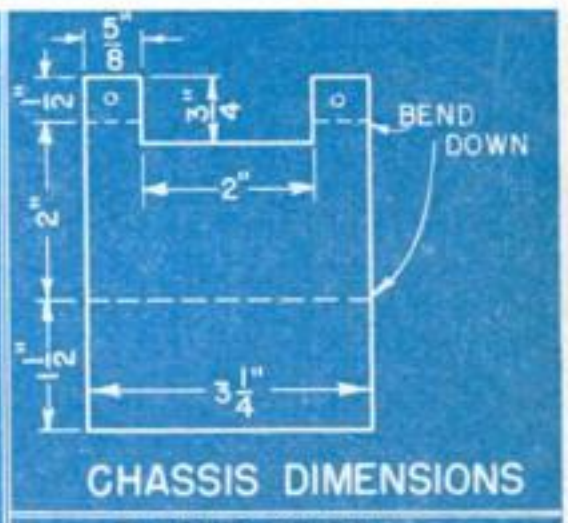
a 50-mmf. mica or ceramic condenser (C6) in series with the "hot" lead from the pickup.

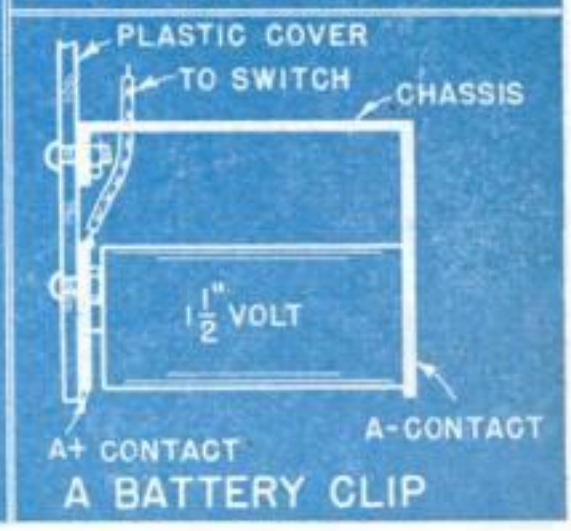
A slightly more elaborate circuit, but one that may give greater fidelity, is shown in inset "A" of the wiring diagram. With this setup volume can be controlled at the phonograph, while with the simpler one it is done at the set.—*Albert Rowley, Manhattan, N. Y.*

LIST OF PARTS

R1: 3.3-meg., ¼-watt carbon.
R2: 2.2-meg., ¼-watt carbon.
R3: 820,000-ohm, ¼-watt carbon.
R4: 1-meg., ¼-watt carbon.
R5: 150,000-ohm, ¼-watt carbon.
R6: 75,000-ohm, ½-watt carbon.
R7: ½-meg. volume control.
C1: .02-mfd., 200-volt paper.
C2: .005-mfd., 200-volt paper.
C3, C5: .0001-mfd. mica.
C4: 75-225 mmf. ceramic trimmer.
C6: 50-mmf. ceramic or mica.
C7: .001-mfd. ceramic or mica.
L1: 456-kc. adjustable iron-core osc. coil.
S1: DPST slide-lever switch.
J: closed-circuit phone jack.
Two 22½-volt hearing-aid batteries, one "C" size flashlight cell, tubes and sockets, crystal-mike cartridge or lapel mike, phono pickup, 25' hank ant. wire, misc. hardware.







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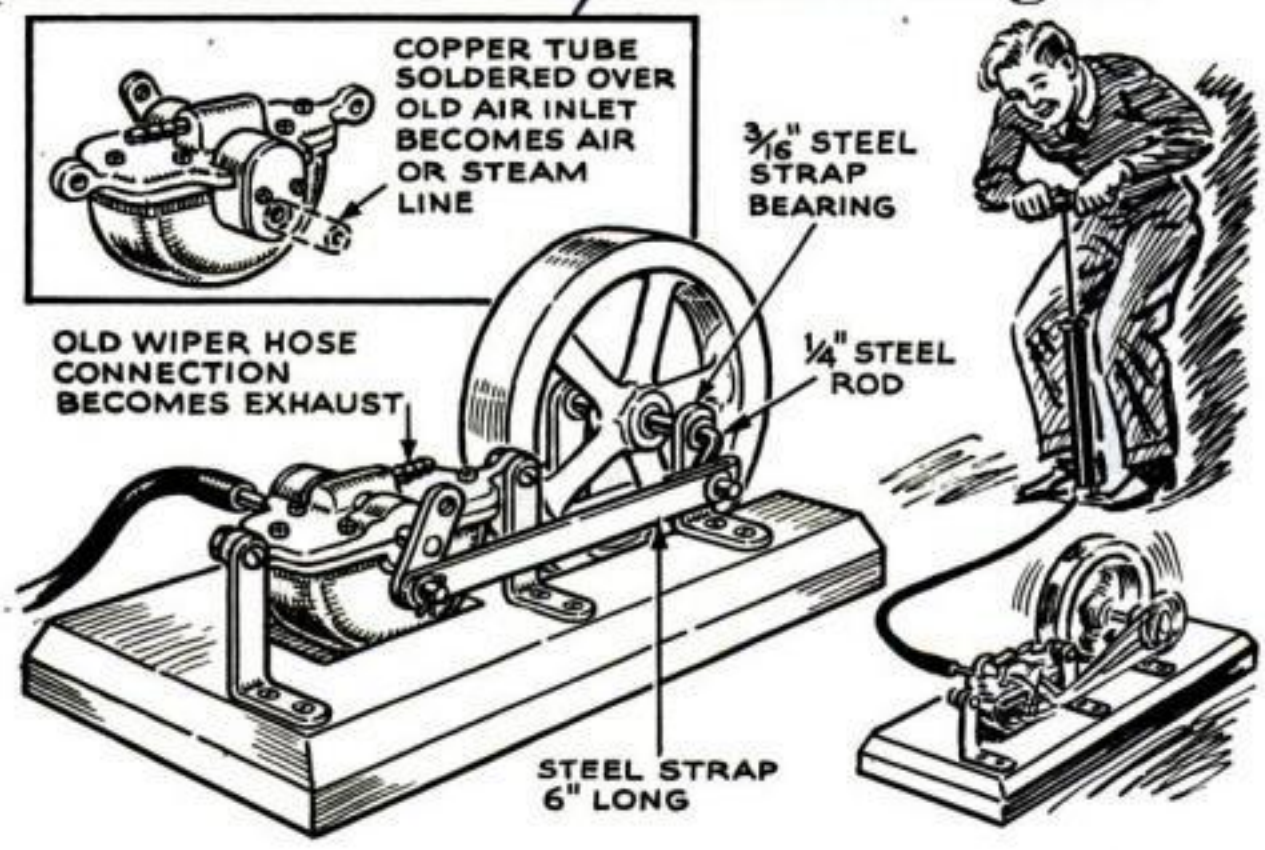
5497

Windshield Wiper Converted into Steam Engine

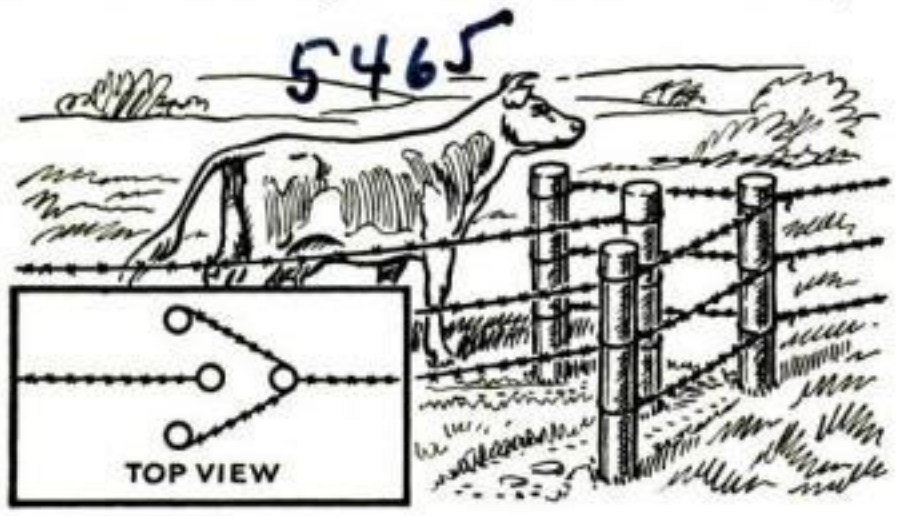
OLD windshield-wiper motors work fine as drivers for toys and models. They'll run vigorously on 3 to 8 lb. from a low-pressure steam boiler, an air compressor, or even a tire pump.

Since the motor must operate on pressure instead of vacuum, solder a small copper tube over the ⅛" air-exhaust hole in the side plate. This will convert it into the inlet pipe; the original hose connection becomes the exhaust.

A 7" clothesline pulley, weighted by a strip of lead in the groove, can be secured to the shaft by filling the hub with lead and drilling it a press fit for the shaft. One side of the oscillating crank is linked to the flywheel by a 6" connecting rod. Make the wheel crank half the length of the wiper-arm stroke. Before applying steam, coat the leather-faced inner paddles with oil or grease.—*R. P. Moodie, Jr., Ottawa, Can.*



5465



Gateless Gate Stops Animals

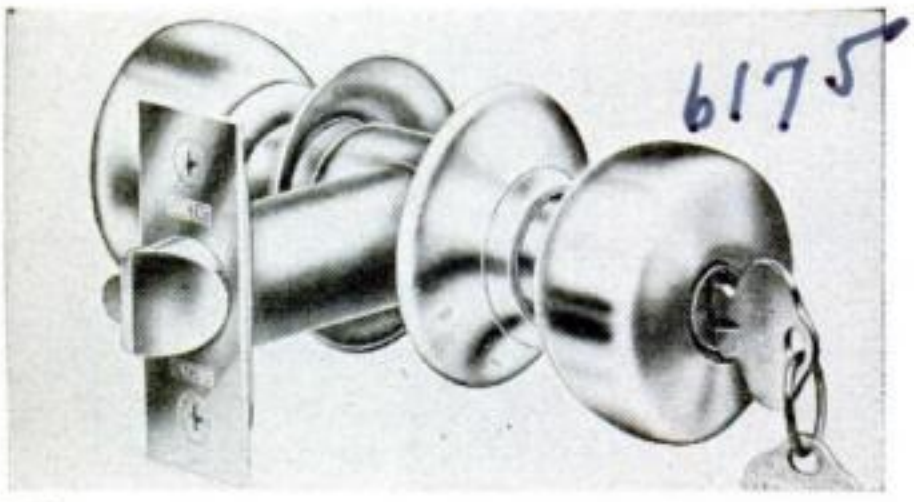
FARMERS will find this V-gate easier to construct than the conventional type. Several of them, spaced along the fence, will keep the barbed wire and the people who cross it from damaging each other. Two in-line posts are placed about 2′ apart, and the wings of the V are separated by 3′ to 4′. The resulting passage is ample for men, but too small for cattle and horses to get through. —*A. H. Sabatose, Brockway, Pa.*



6173

Sounding Rod Is Electrified

THE familiar sounding rod, long used by mechanics as an aid in locating the source of motor trouble, is now offered in an electrified, amplified version by Como-Tex Co., Inc., Chicago. The instrument consists of an aluminum probe, microphone, transformer, and earphones. It is powered by five flashlight cells. Sound is said to be amplified 400 times from the probe to the phones.



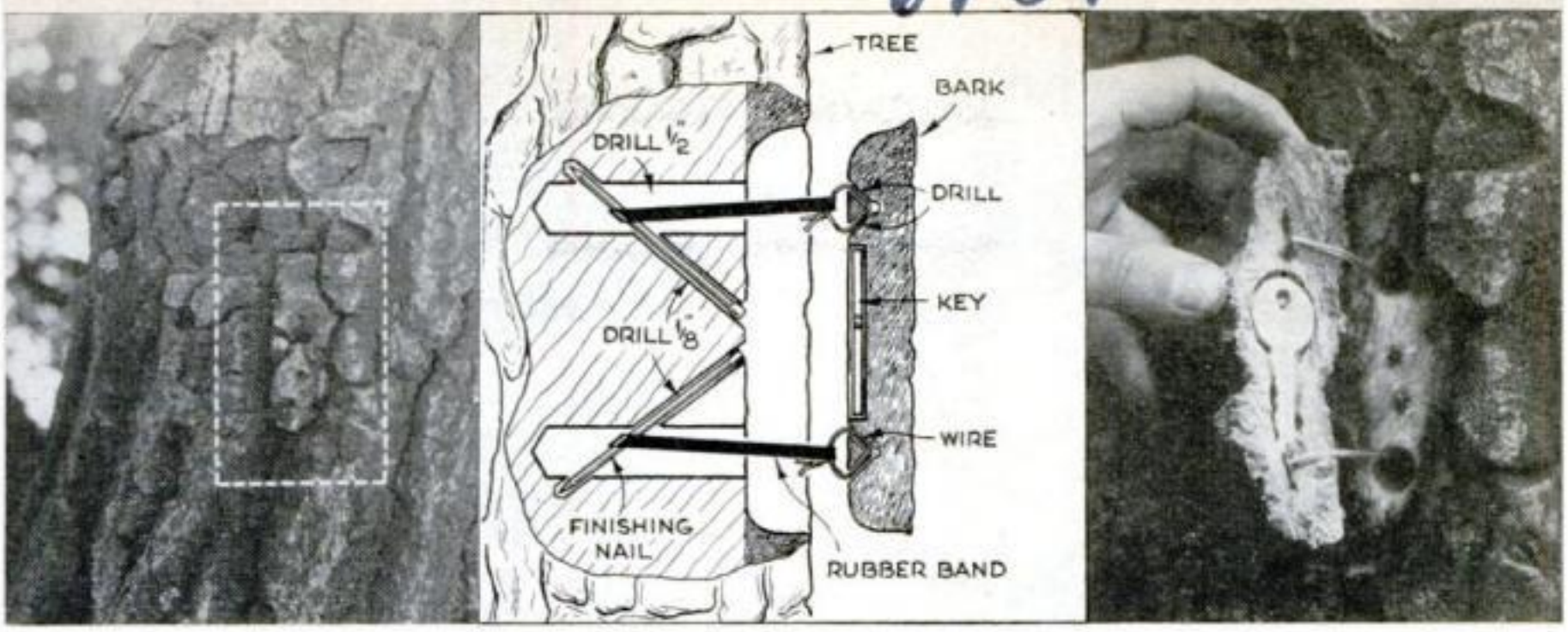
6175

Lock Installed with Two Holes

A NEW series of door latches manufactured by Sargent and Company, New Haven, Conn., can be installed in wood or metal doors without mortising. The latch bolt is inserted in one hole, and the knob shaft in another. Locks are set into the knobs. Bathroom latches come with a key for opening from outside in emergencies.

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6202



Secret Cache Cut in Tree Holds House Key

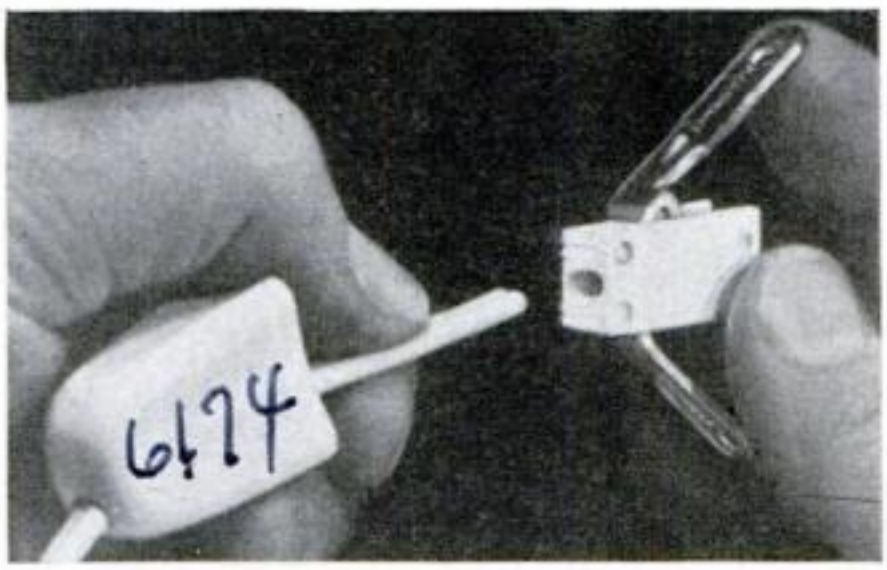
HIDING a spare front-door key for emergency use at our home is no longer a problem. A loose piece of tree bark, hollowed to fit the key, is held to the trunk as shown in the drawing and photos. The bark was removed by cutting around its natural contour with a sharp knife. After carving a niche for the key, the piece was drilled for two small wires to anchor the rubber bands. A screwdriver was used to force the rubber bands into the two ½" holes in the tree, where they are held in place by finishing nails driven into the ⅛" holes. It is a simple matter to pull the bark back to get the key, and the bands snap it back in place.—*Don G. Pittwood, Moscow, Id.*

Test Tank Made of Large Tire

6205



A SECTION of a large aircraft tire may be cut to form a tank to check inner tubes for leaks. The improvised tank is large enough to handle truck inner tubes.—*Carl Tretin, Austin, Minn.*



6174

Plug Connects Automatically

NO TOOLS are necessary to connect this new plug made by Academy Electrical Products Corp., New York, N. Y. Metal points on the hinged prongs pierce the insulation of the wire and make contact. The inner unit then is slipped back into the cover. Both parts are made of Plaskon ®.



6211

Oil Lengthens Saw-Blade Life

WHILE jigsawing a batch of sheet aluminum, the blade frequently broke. I found that the blades lasted a lot longer if I oiled them from time to time. To keep the oil where it was needed, I used a small piece of felt that pressed against the rear of the blade and overlapped the sides a little. A bent paper clip, fastened under the guide-holding bolt, held the felt. Just a few drops of light oil on the felt from time to time did the job.—*Walter E. Burton, Akron, Ohio.*

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Pianos aren't tough to fix if you're a careful worker. Here a grand's action is removed.

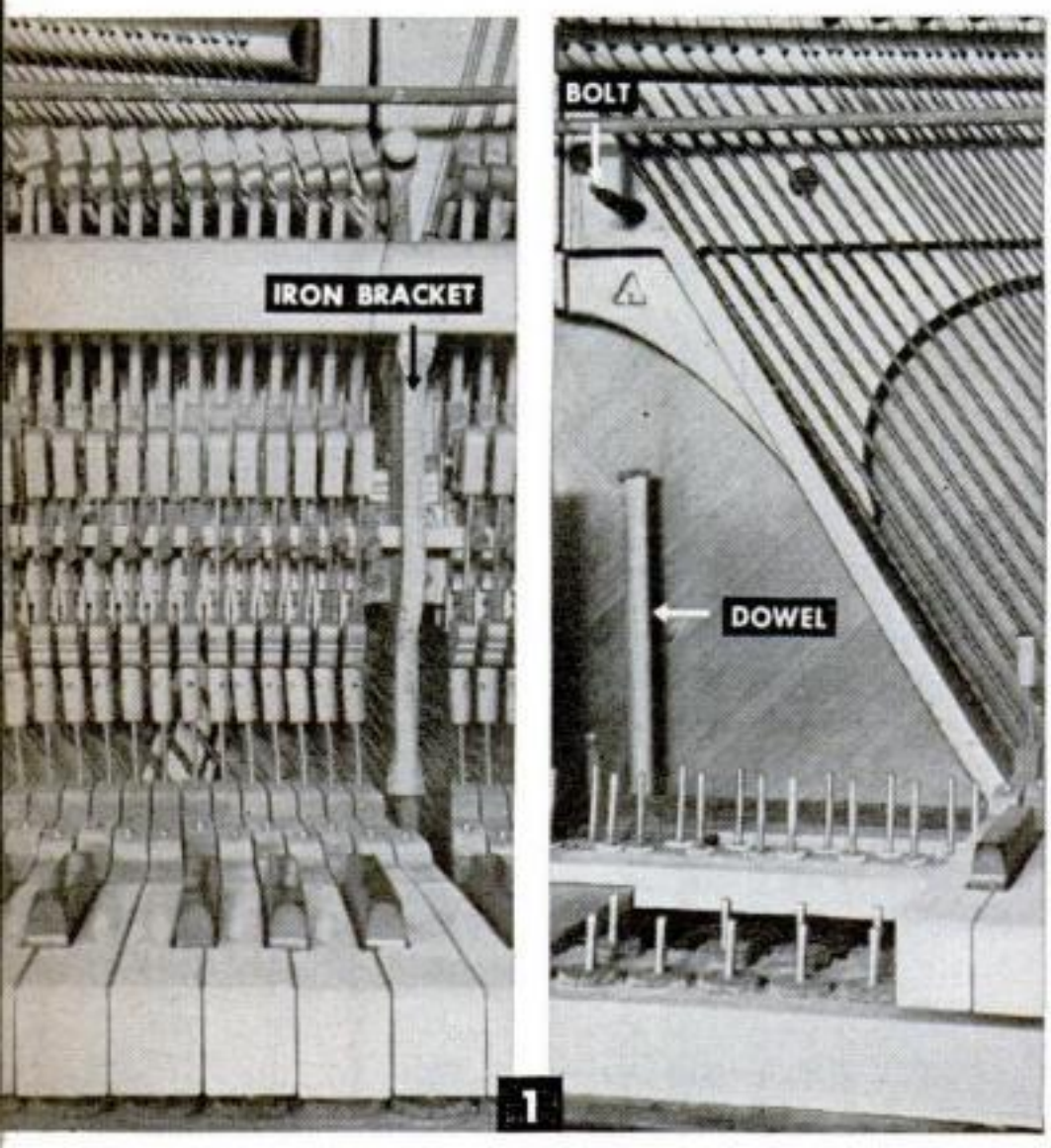
Sweetening the Sour Notes

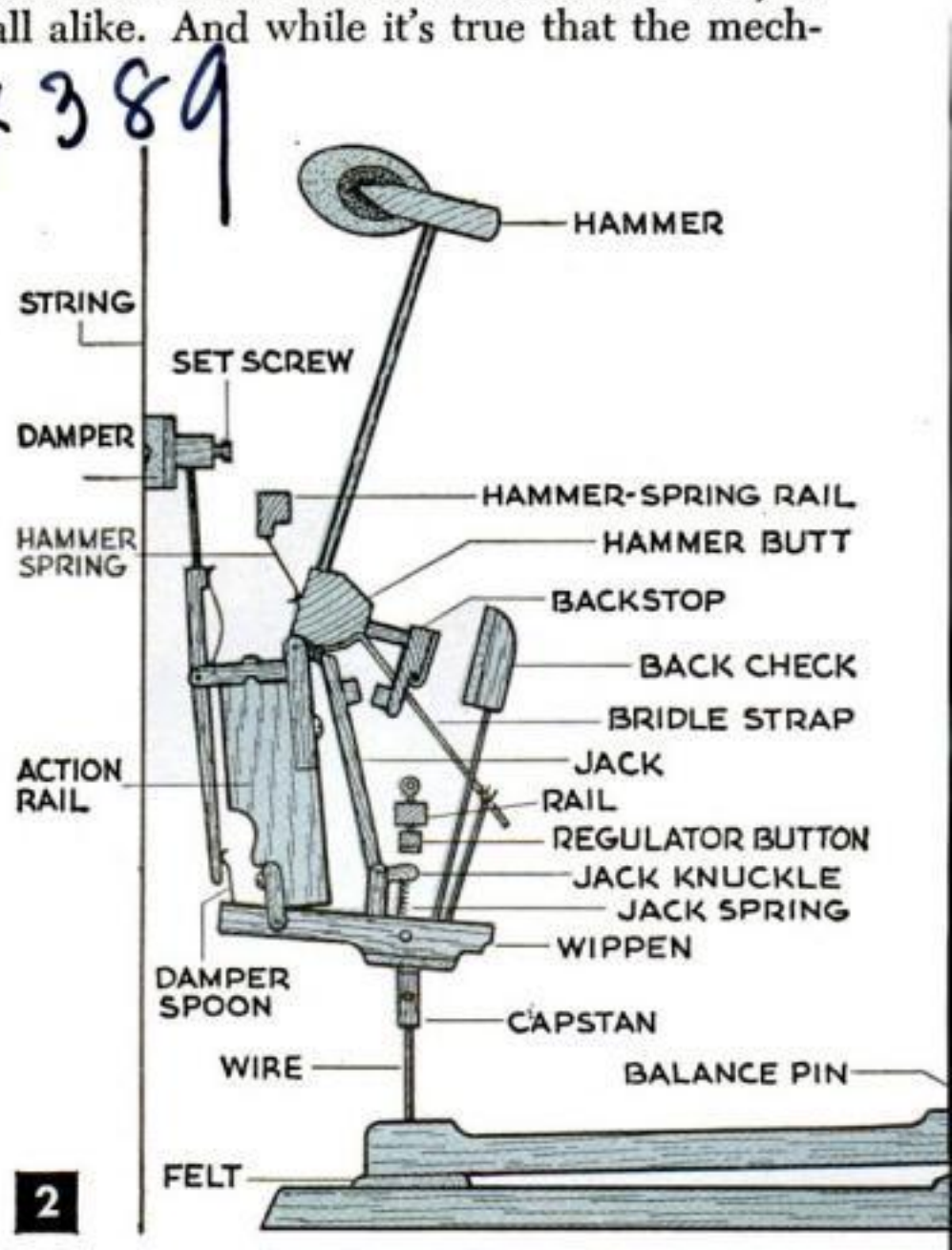
Even if you think an octave is a fish with eight arms, you can repair your own piano.

By Al Scott

THE first time I saw the inside of a piano, I took one quick peek and slammed the lid down. It looked like an abandoned wire-manufacturing plant scrambled with a few wagon loads of scrap lumber.

Actually, it wasn't that bad at all. The strings, hammers, and straps began to make sense when I took a more careful look. After all, even though there are 88 keys, you just have to understand the action of one and you know the action of the other 87. They're all alike. And while it's true that the mech-





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anism of a piano requires fine adjustment, a careful craftsman if not afraid of delicate work can make many repairs.

Getting to the mechanism of a piano is almost as easy as raising the hood of a car. In the case of the upright piano, fold back the lid and look around for the screws that hold the music-rack board. Assemblies differ, of course, but you'll probably find the board hung on a couple of screws set in the sides of the case. Lift this board out.

Then look under the keyboard for the screws holding the blocks at each end of the keyboard and for the screws that keep the front rail in place. (That's the rail just in front of and a little below the keyboard.) Back out those screws and then you can lift out the front rail, the blocks, and the fall board that covers the keys.

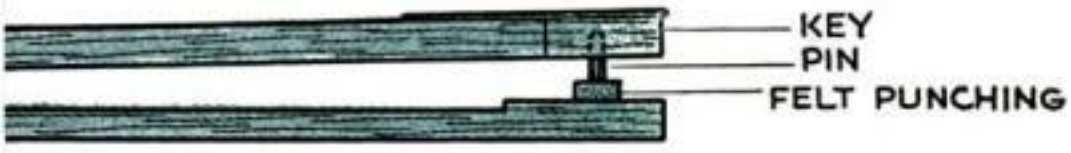
By now your piano should look like the left side of Fig. 1. The other part of Fig. 1 shows a section of an upright piano after the action and some of the keys have been removed. The iron bracket is cone-shaped at the bottom, where it rests on a ball pointed bolt. The top of the bracket is forked and is held to a bolt by a nut. Usually there are four such brackets. Remove the nuts, pull the action toward you, and raise it up and out. If the dowels running up from the pedals are screwed to the action, first remove those screws, of course.

The keys are held in position by the pins shown in Fig. 1. Should a key rub an adjoining one, tap the pin over until you get proper clearance. Lift all the keys out, and use sandpaper to remove any rust from the pins. Renew any felt punchings on the pins if necessary, and clean under the keys with a vacuum-cleaner attachment.

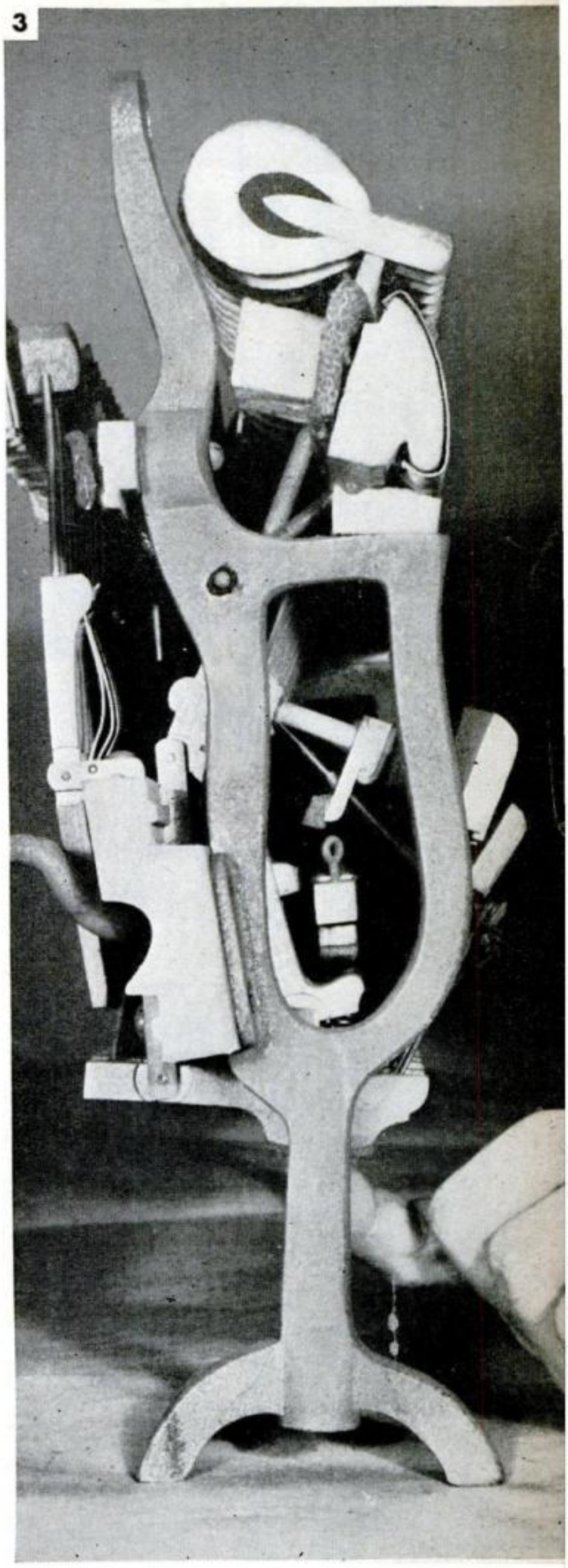
Figure 2 shows you the action of a single key of an upright piano. Figure 3 is the bass end and footed bracket of an upright's action. For clarity, the supporting iron framework is not shown in the drawing. Here's what happens when you push down a key:

The key seesaws on the balance pin, raising the capstan. In this case, the capstan is a short piece of dowel threaded on a heavy wire. There should be no play between the capstan and the wippen. Insert a nail in the hole in the dowel to turn it until it is snugly against the wippen.

The capstan moves the wippen upward,



3



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bent like buckles to hold bridle straps. This strap hastens the return of a hammer for repetition. You may find some of these straps worn or broken. They can be replaced with a slitted-type strap that slips over the backstop as shown in Fig. 5.

Dampers and hammers are attached to the action rail by screws. In the case of the hammer, the screw will seem to be inaccessible, being hidden behind the top of the jack. However, the jack is flexible enough to be pushed aside with a screwdriver. If a hammer stem is broken, replace it or glue it together and wrap it with silk thread.

If the felt on a hammer head has hardened, remove the hammer from the action and soften the felt with a needle. Use a No. 5 needle. Jab it several times into the felt on the top and bottom of the head. Don't stick the interior felt and don't shove the needle into the part of the felt that strikes the string. If the felt is deeply grooved from striking the string, reshape it with fine sandpaper.

Now let's compare the action of an upright and of a grand. The action of an upright lifts out, leaving the keys in place on their pins. The action and keys of a grand slide out of the piano in one complete unit. On a grand you'll also find the front rail and end block held by screws underneath. Grasp the keyboard at each end and slide it out by pulling it toward you.

You have to be careful here. If a hammer is up or is raised while you are removing the unit, you may snap a hammer stem.

Figure 6 is the treble end of a grand's action, while Fig. 7 shows you the various parts. The action is very similar to that of an upright. When a key is depressed, the capstan raises the wippen. The jack passes through a slot in the repetition lever, pushing against the roller and raising the hammer until the jack is tripped off the roller by the knuckle hitting the regulating button.

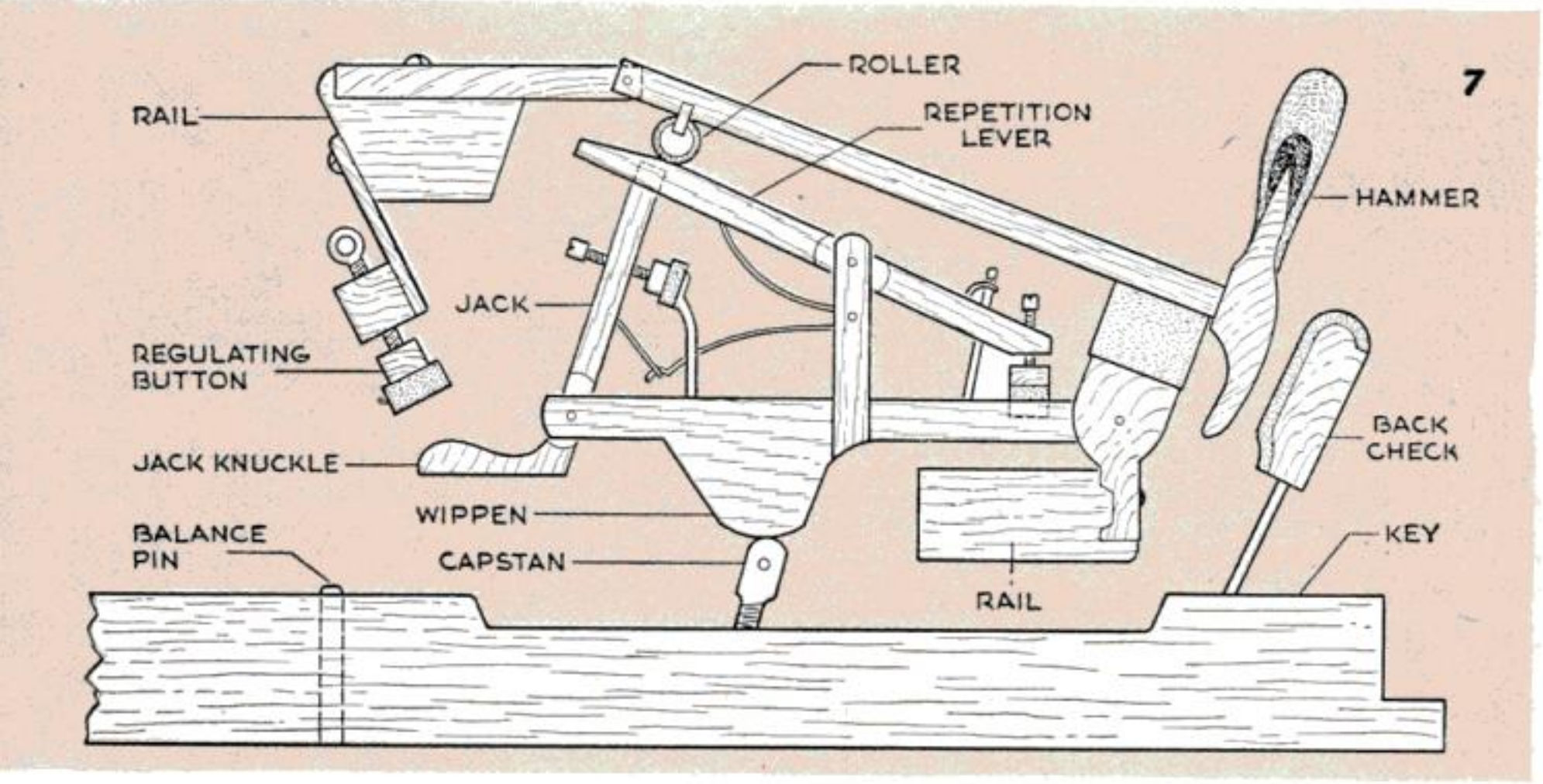
Turn the screw eye of the regulating button so the button trips the jack when the hammer is about 5/32" from the string.

In general, the mechanisms of all pianos require many pieces of felt of various sizes and thicknesses as well as numerous springs. When going over your piano, keep a sharp lookout for wrinkled felts and loose or broken springs. Replace or tighten these parts where necessary.

Keys that have yellowed may be reconditioned by first scraping them carefully with a razor blade, and then polishing them with whiting on a dampened piece of felt. The whiting, springs, felt, and a special glue for loose ivories or black keys may be bought at piano supply houses.

Here are some approximate prices on replacement parts: Bridle straps, $1.25 per hundred; hammer head, 15 cents; hammer stems, 25 cents a dozen; hammer butt, 20 cents; wippen assembly, 25 cents; capstan, 15 cents; complete set of punchings for under keys, $5; and miscellaneous felts, such as butt felts, 20 cents a hundred.

For comparison, tuning and replacement of bridle straps alone costs about $15. END



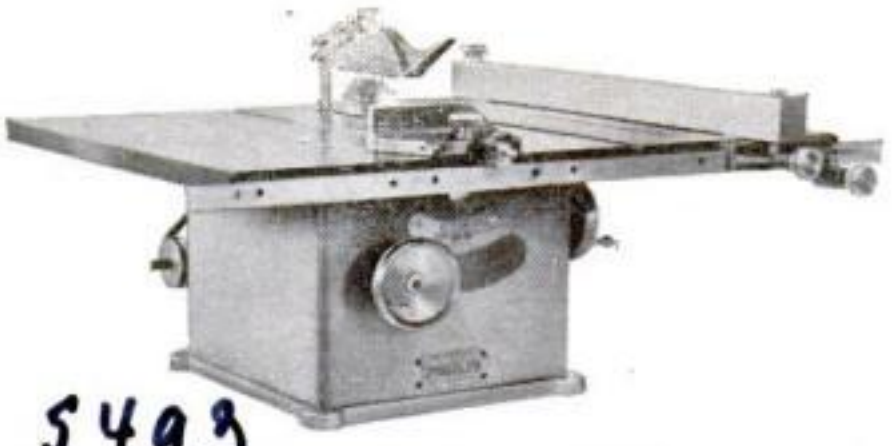
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NEW TOOLS



Wrench Reaches Tight Spots. Here's a new open-end ratchet wrench designed especially for use on pipe, tubing, conduit, cable, and rod fittings in restricted areas. The ratchet heads operate in an arc of 7½ deg. or less. Heads, sockets, and accessories may be bought separately or in sets. An adapter also makes it possible to use standard sockets with the head. Sets sell for about $15. C. J. Hendry Co., San Francisco, is the maker.



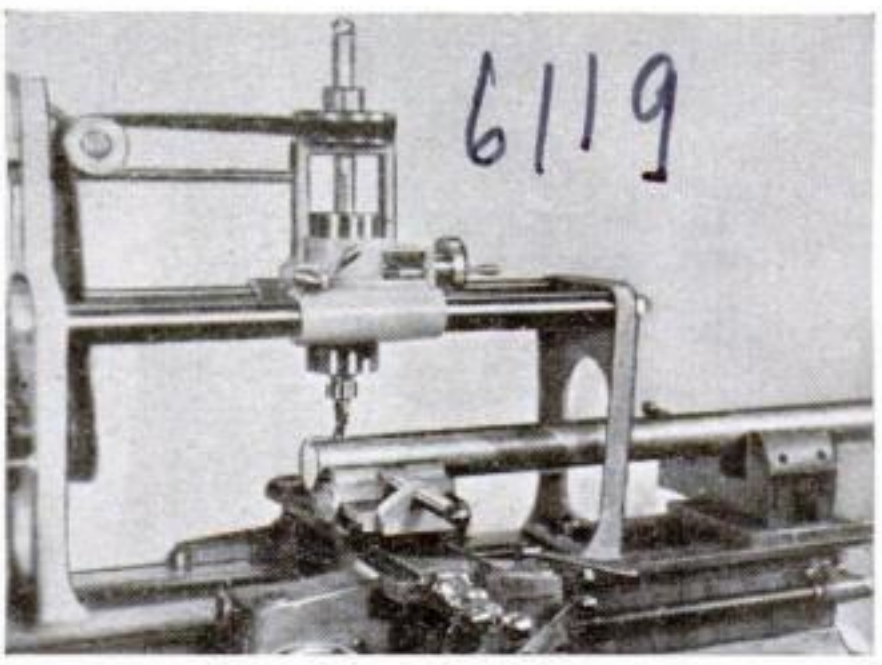
Saw Has Big Table. With accessory extensions, this tilting-arbor table saw offers a 24″ by 42″ work area, 12″ in front of the 8″ blade, and 25″ between the blade and fence. The motor tilts with the arbor, the table has a measuring scale, and a pinion knob provides fine fence adjustment. Westbuilt Metal Products Co., of Los Angeles, makes it for about $90, extensions extra.



Magnifier. A light hammer with a built-in seven-power lens is made by the L. S. Starrett Co., Athol, Mass. Intended primarily for tool and die makers, it makes possible accurate spotting and punching of centers and intersections. Weighing only 4 oz., the hammer is made with flat and ball-peen heads, which are offset to permit close work. Price $2.75.



Midget Tools Aid Hobbyists. A set of midget woodworking tools for the use of hobbyists is offered by Toddward Products, Buffalo, N. Y. Made of cast aluminum, the tools have steel cutting edges. The plane is 1⅛″ wide, 3⅜″ long, and has a ⅞″ blade. The spokeshave has a 13/16″ blade, as does the end shaver or scraper. The tools are sold as a kit for about $2.



Vertical Miller Fits on Lathe. A milling attachment that clamps on the ways of a bench lathe is offered by Palmer Industries, Inc., Chicago. To hold the work, the compound rest is replaced with a vise that's furnished with the mill. The unit will make an 8″ cut on the longitudinal feed and half that distance on the cross feed. It handles stock up to 3″ dia. Price about $100.

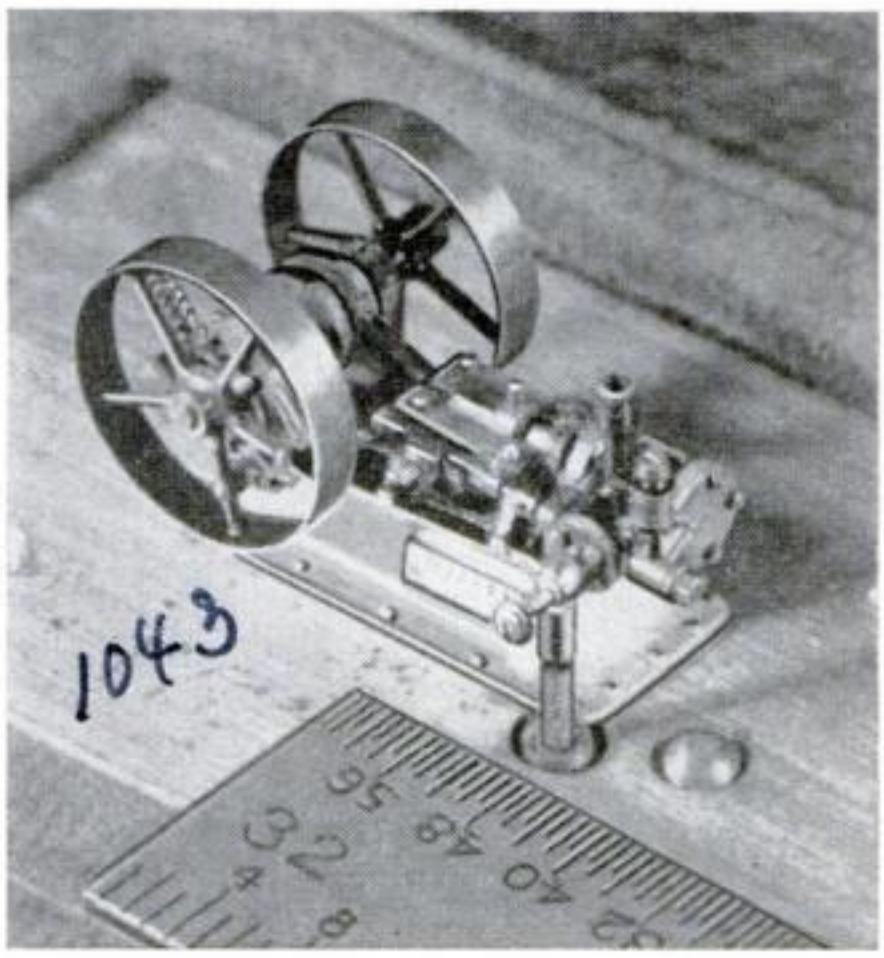
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Craftsmen Show Their Work

5464



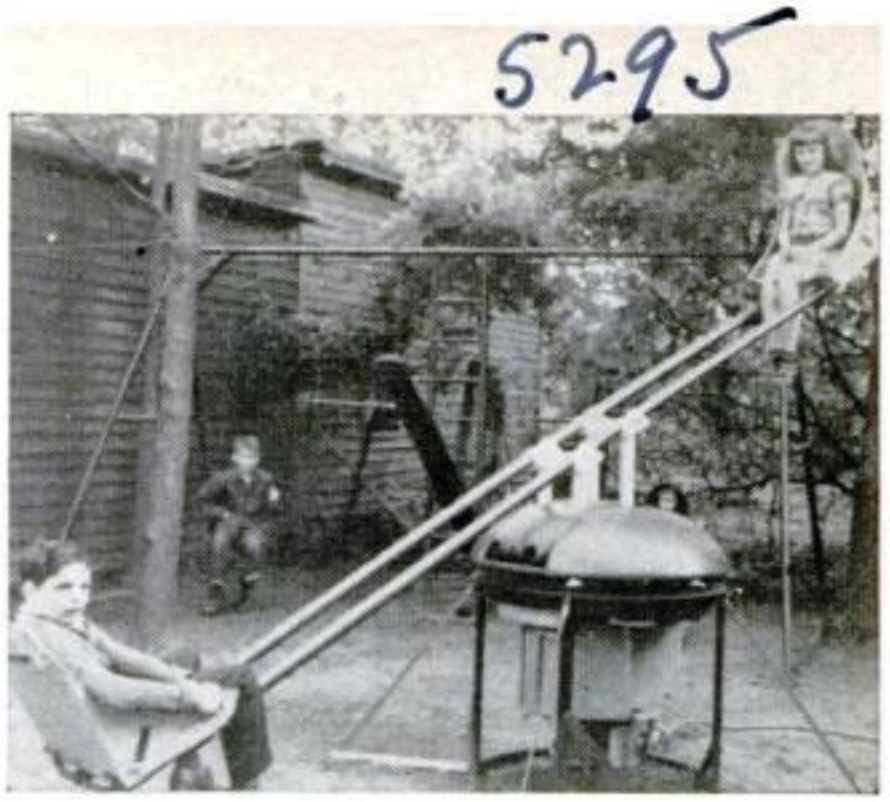
Kitchen Lamp. Mrs. William J. Ortgier of Bell, Calif., wanted a lamp for her cooking quarters. Her husband filled the order—with a vengeance. This culinary masterpiece is made of a plant-filled dessert mold, a round snack board, a coffee maker, and a colander. There's a bulb and socket and some wire in there, too.



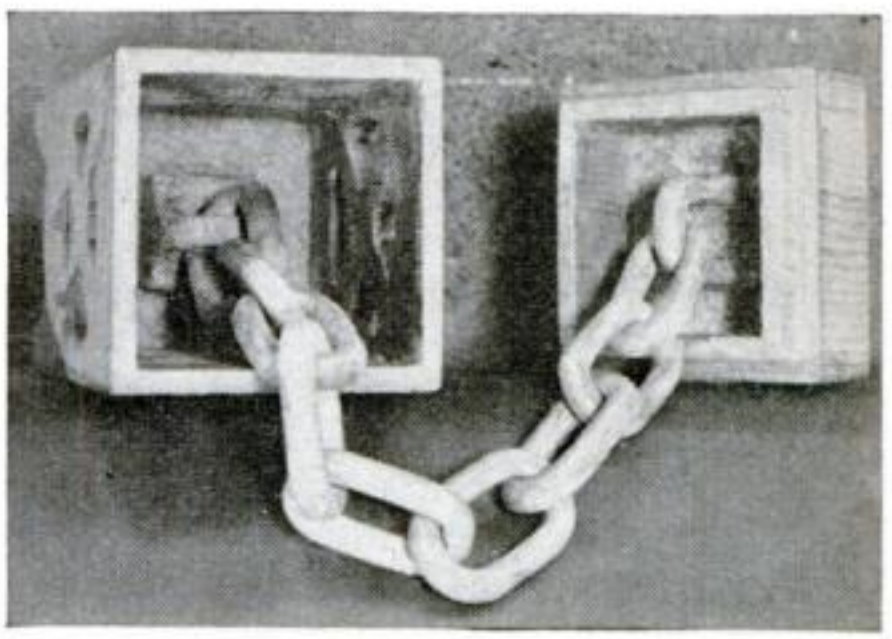
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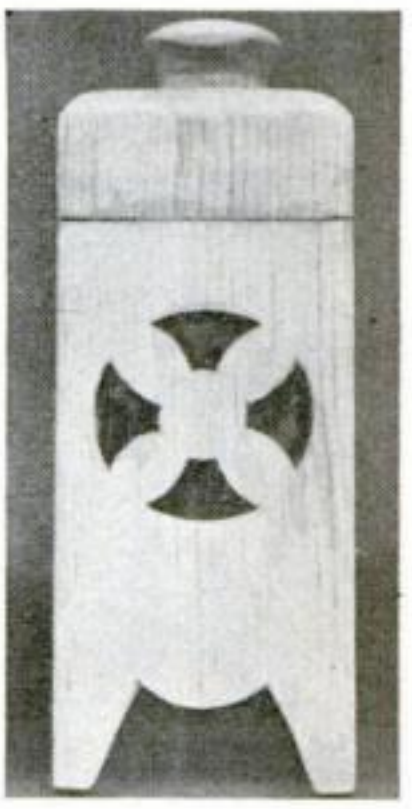
Tiny 1892 Engine Still Runs. Certainly one of the smallest working models ever built is this 56-year-old testimony to the craftsmanship of C. H. Allen, Sr., of Pittsburgh. It measures a mere ¾" in length and is 7/16" wide. Stud bolts are .008" dia. and have 750 threads per inch. The engine boasts a double disk crank, a flywheel governor, a cylinder lubricator, and a throttle valve. Piston and valve rods run through packing glands. Output of the midget steam engine is estimated at .0002 hp.

5295



Seesaw Goes Round and Round. A two-seater merry-go-round and self-acting seesaw was built almost entirely from surplus and scrap parts by E. C. Mitchell, of Atlanta, Ga. Two ½-hp. DC motors, shunt-connected, are powered through a step-down transformer and copper oxide rectifier. Both of the latter are home made. The center housing is a machine gun turret from a B-29. It turns at about 8 r.p.m. A pair of aluminum bucket seats are spaced about 12′ apart.



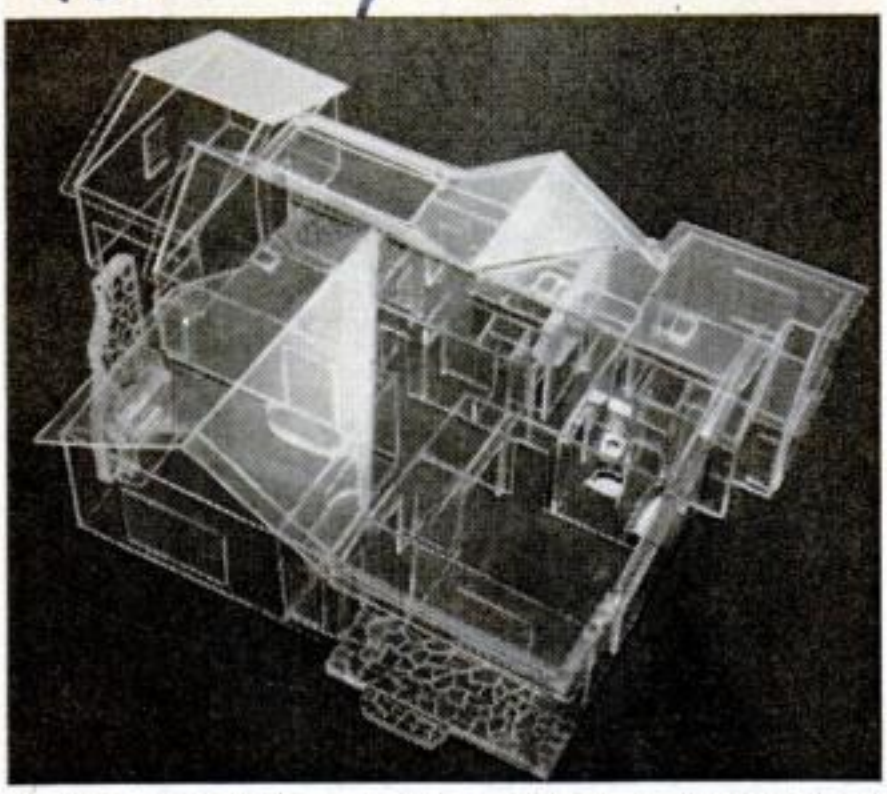


One Piece. A solid block of wood that measured 3¾" by 3¾" by 20" at the start was whittled inside and out to produce this chain and box. The chain is connected to both the lid and box bottom. Finished size of the box is 3¾" by 3¾" by 10". This intricate project is the work of Ben F. Ross, a master whittler, of Schenectady, N. Y.

3290

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written by James P. Trent, 426 E. Gray St.,
Norman, Okla.



A blueprint in plastics. With a transparent model you can avoid cost of putting in last-minute extras or leaving something out.



Putting a roof in place. Plastic solvent bonds all pieces. Roofing is the most time-consuming part of the job, the modelmaker says.

52 88

Three-Dimensional Blueprints in Plastic

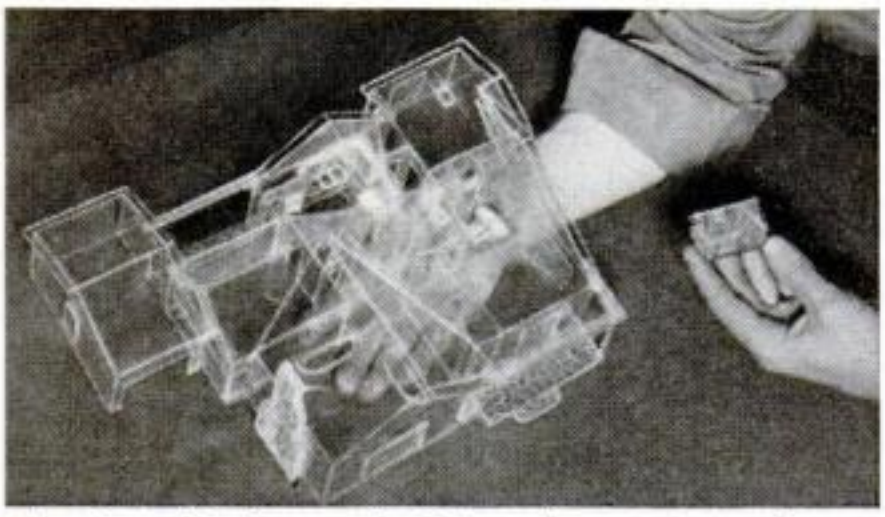
IF MR. BLANDINGS could have peeked through transparent walls into a scale model of his dream house, he might have had fewer nightmares during its building.

Shannon S. Hughes, Oklahoma City electrician, constructed a transparent plastic model of his own dream home just as a hobby. The hobby has grown into a business. Tools used for making the models are an abrasive wheel for cutting, a rotary electric tool for marking and small detail work, and a file to knock off rough edges.

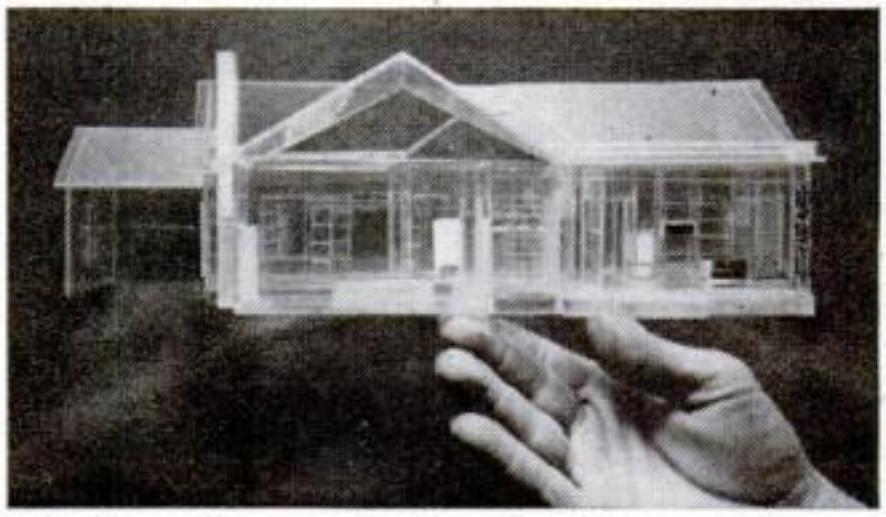
Plastic sheets 1/16" thick are used for the average house. Larger models require ⅛" thickness. Hughes first outlines and cuts the floor arrangements according to the blueprint. Walls and partitions are cut out and set in place on the floors. Doors are glued to floor and jambs in a swinging position, slightly ajar. Windows and doors are standardized and made up in stock form.

Roofs, Hughes says, are as much work as all the rest of the house together. To save the trouble of making beveled cuts at the ridge, he overlaps one side. Miniature plumbing and kitchen fixtures are installed before the roof is added.

Because plastic can be bent, twisted, and shaped into compound curves, even unconventional modern designs can be modeled. Hughes charges $6 per $1,000 up to a $10,000 home, but has a sliding scale for the larger jobs. He already has sold over 40 models

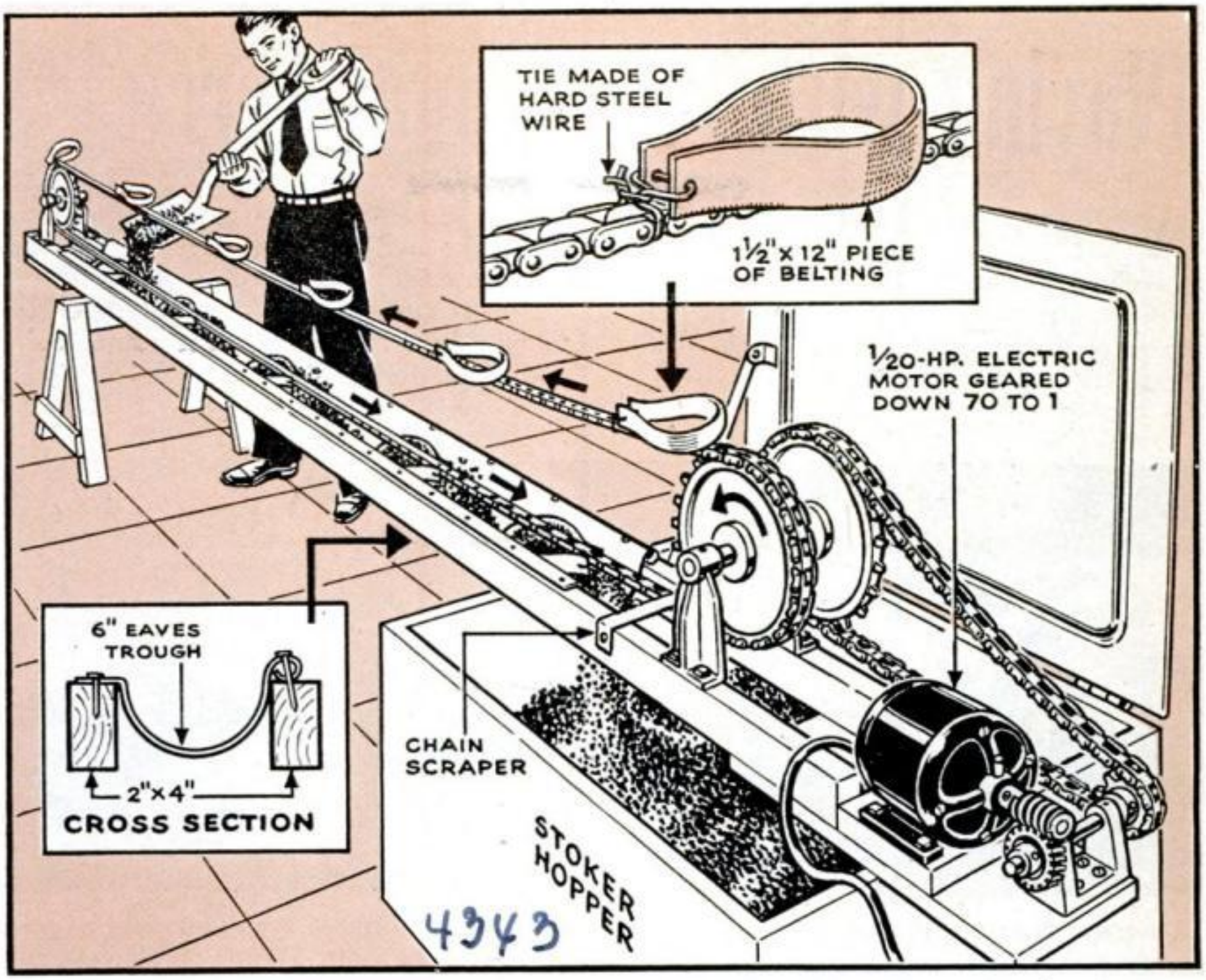


Hughes displays a 1/20" to 1' miniature house on the right in contrast to the usual ¼" to 1' scale model held in the other hand.



Window, door and other details are easily perceptible. The models help eliminate constant changing of architects' plans.

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Conveyor Moves Coal from Bin to Stoker Hopper

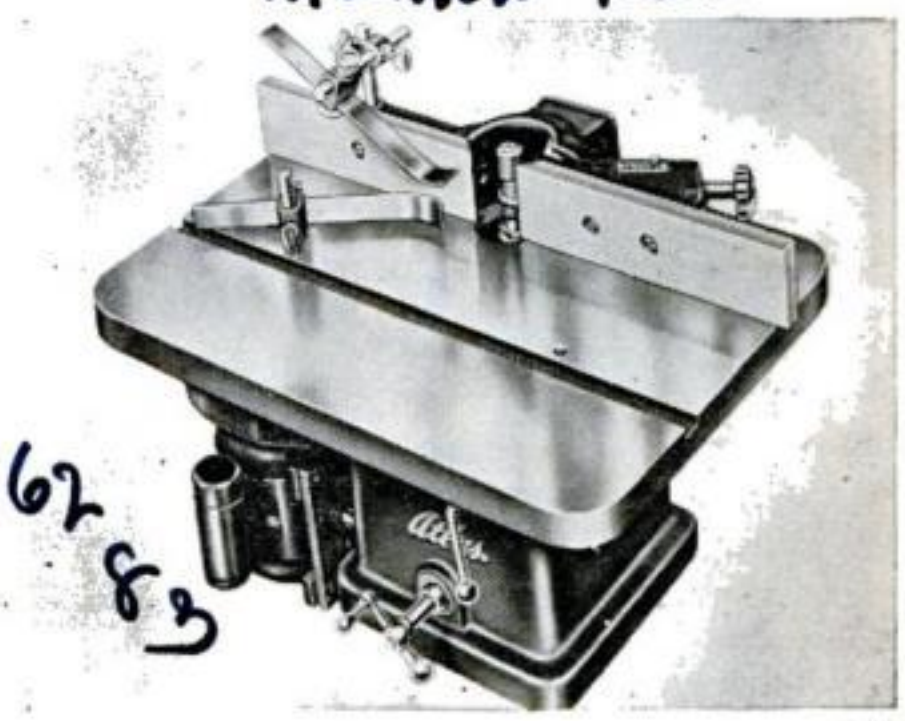
SINCE the distance from my coal bin to the furnace was too far to walk with each shovel of coal, I rigged this conveyor to move the coal from the bin to the hopper above the stoker.

The trough is a length of 6″ eaves gutter nailed between two pieces of two-by-four. At each end is a sprocket to carry the conveyor chain. I made the loops that drag the coal along the trough from 1½″ by 12″ pieces of belting, and wired them to the chain. With the motor geared 70 to 1, I spaced the loops of belting 2′ apart. This arrangement moves the coal away as fast as I shovel it into the trough.

Note the scraper just in front of the sprocket nearest the motor. This is a metal strip bolted across the two-by-fours to scrape coal from the chain before it reaches the sprocket.—*H. Lester Hunt, Easton, Pa.*

Atlas Offers Spindle Shaper

FEATURES of this shaper made by the Atlas Press Co., Kalamazoo, Mich., include a 15″ by 21″ table with 2″ vertical travel, a heavy fence giving 1¼″ depth-of-cut adjustment and ½″ screw adjustment of one face for planing, sealed ball bearings, and a rear-mounted motor support. The table is drilled for hold-downs and guide pins, and grooved to take a miter gauge and sliding fixtures. Cutters 1½″ high and sanding drums 2 3/16″ in diameter will fit on the ½″ shoulder of the ¾″ spindle. The shaper is designed to be operated from a ½-hp., 3,450-r.p.m. motor.



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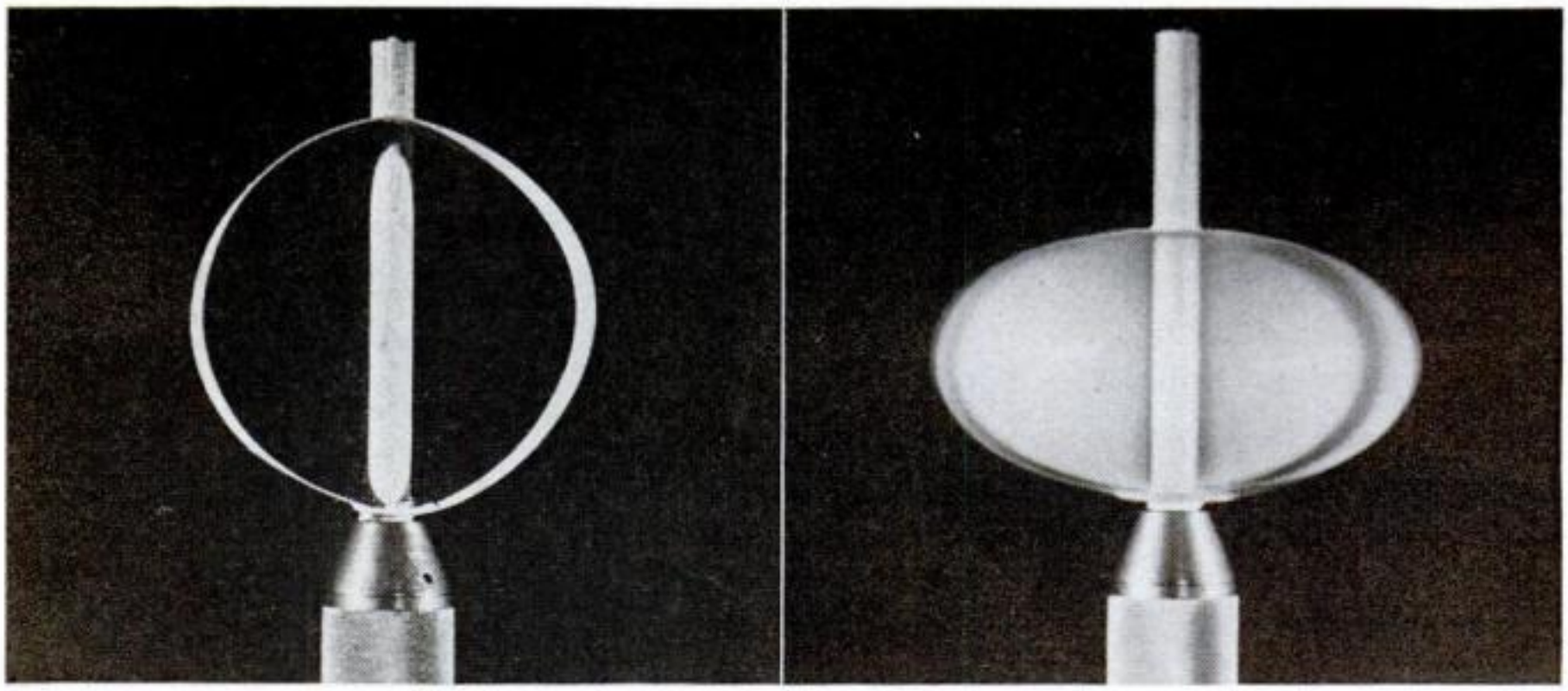
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Playing with Centrifugal Force

ANY driver who's taken a curve fast knows that a moving body wants to keep traveling in a straight line. Only an outside force will make it do otherwise. Centrifugal force is the strenuous reaction of such a body to any force diverting it from a straight line. When you whirl a ball on a string, the pull is the reaction to the force you're exerting to keep the ball moving in a circle. Let go, and the ball flies in a straight line. Here are other examples of centrifugal force.



Paper Saws Paper. The faster a body moves, the more force is needed to restrain it to a circular path. Hence, as a reaction, the more force seems to be exerted outward. Above is a demonstration of this. Mount a 6″ disk of typewriter paper on a motor-driven shaft. While motionless, the paper is quite limp. But rotated at high speed, the disk becomes so rigid that it will easily saw through a sheet of paper.

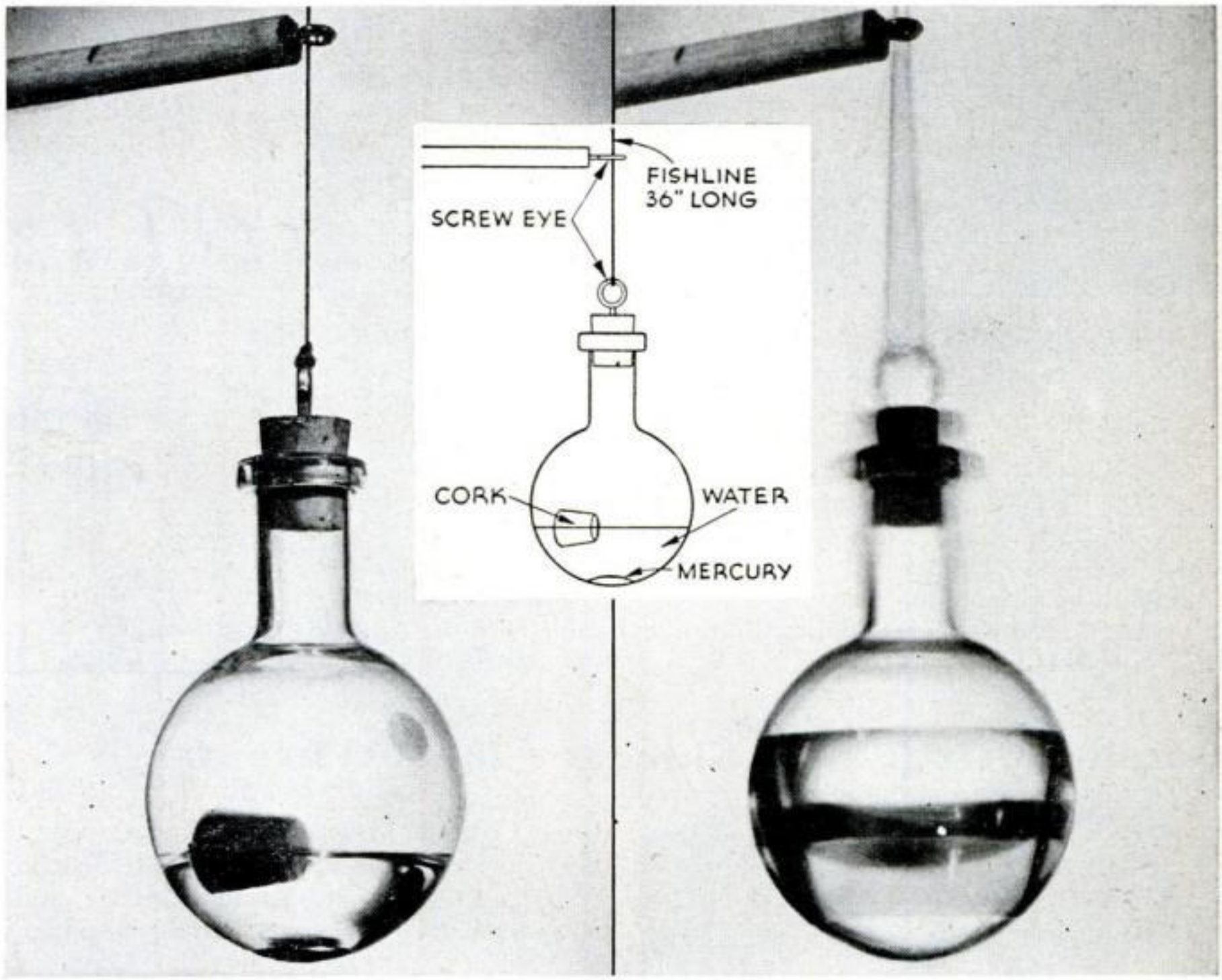


How a Governor Works. As a rotating body speeds up, the tendency to fly outward becomes greater. This is put to use in the centrifugal governor. You can show the operation of such a governor by forming a strip of 1″ cardboard into a 6″ ring and pushing a dowel through holes on opposite sides. Make the ring a loose fit on one side. Cement it to the dowel on the other. Mount the dowel in a drill or flexible shaft held vertically. The ring flattens more and more as it turns faster.

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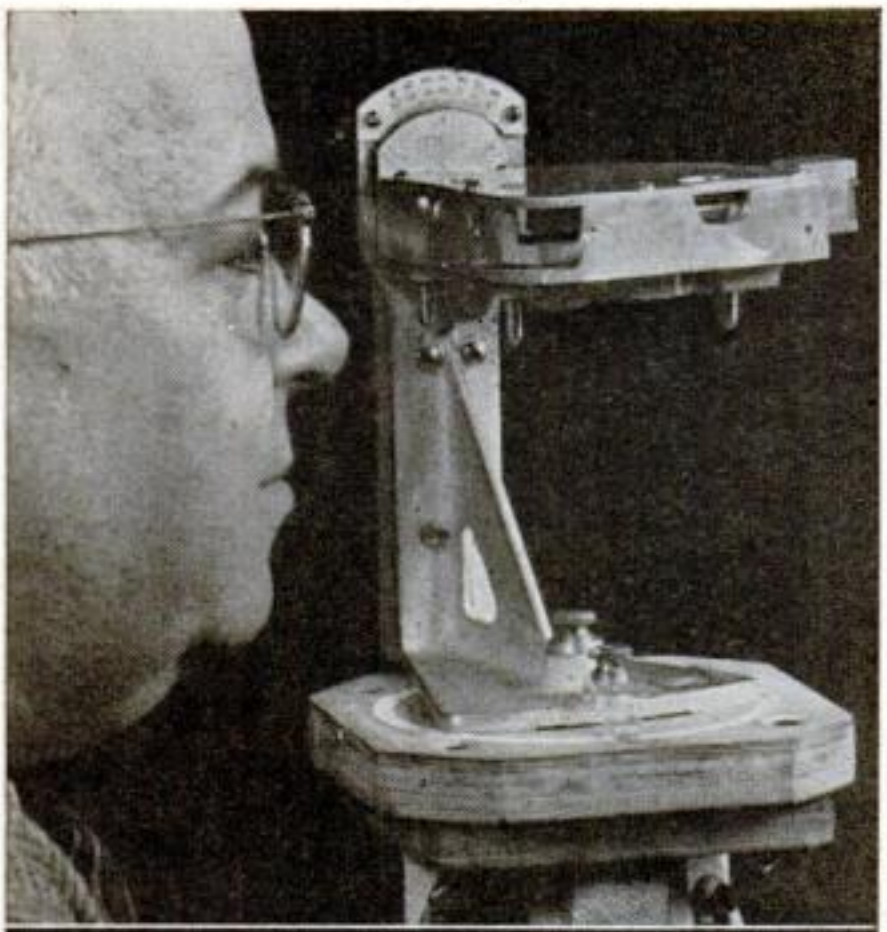
Rotation Versus Gravity. Although the earth revolves at about 1,000 m.p.h., the pull of gravity toward its center keeps us safe. Theoretically, if the earth speeded up to a certain point we'd all fly off. Here's a setup to show the relationship between rotating speed and a center-pulling force. The latter here is exerted by two rubber bands slightly shorter than the radius of a cardboard disk that's mounted on a motor shaft. At moderate speed, a small cork tied to the joined rubber bands remains near the disk. But speed up the motor and the cork flies out in a widening circle.



Simple Centrifuge. At a given speed of rotation, dense substances have a stronger tendency to fly outward than light ones. Centrifuges and cream separators work on this principle. Here's a homemade centrifuge. Twist the string until it has shortened about 4″. Then let it go. As the flask rotates, the liquids climb the sides, as at right. At top speed, the mercury forms a narrow band at the middle of the flask, with water above and below. The light cork whirls about in the center.

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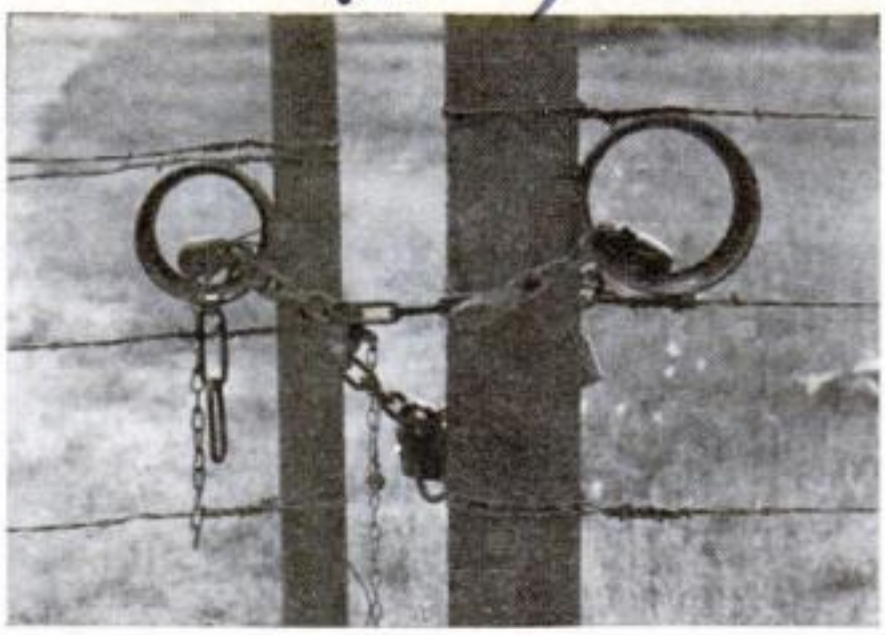
6178



Simple Transit for Amateurs

You don't need to be an engineer or a surveyor to use this new quadrant transit, according to the maker, Fenton Crafts, of Fenton, Mich. Farmers, carpenters, and others can use it to run lines for roads, foundations, building lots, fences, ditches, and other jobs. The assembly includes an aluminum head mounted on a swivel stand, a leveling base, and a 54″ adjustable tripod. It is priced at about $20.

6204



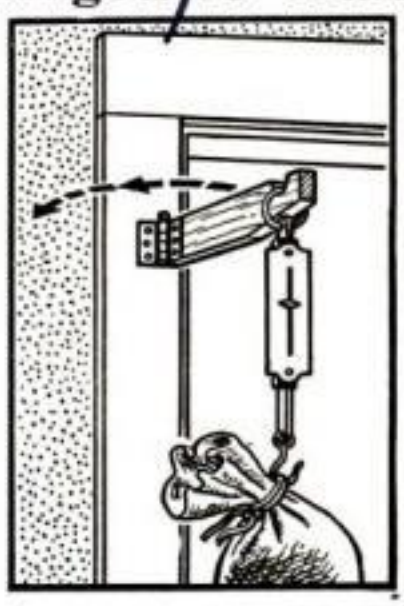
Many Locks Hold Public Gate

To AVOID distributing numerous keys to a single padlock, each of several companies having access to a community area here uses its own lock—all being joined by short lengths of chain. Thus the unlocking of any lock will open the gate, and responsibility can be fixed on anyone leaving it open. Pipe collars were welded to the post and to the gate, the chains and locks passing through them. This makes it easy to rotate the string, preventing the chains from catching on the barbed wire.—*Elton Sterrett, Houston, Texas.*

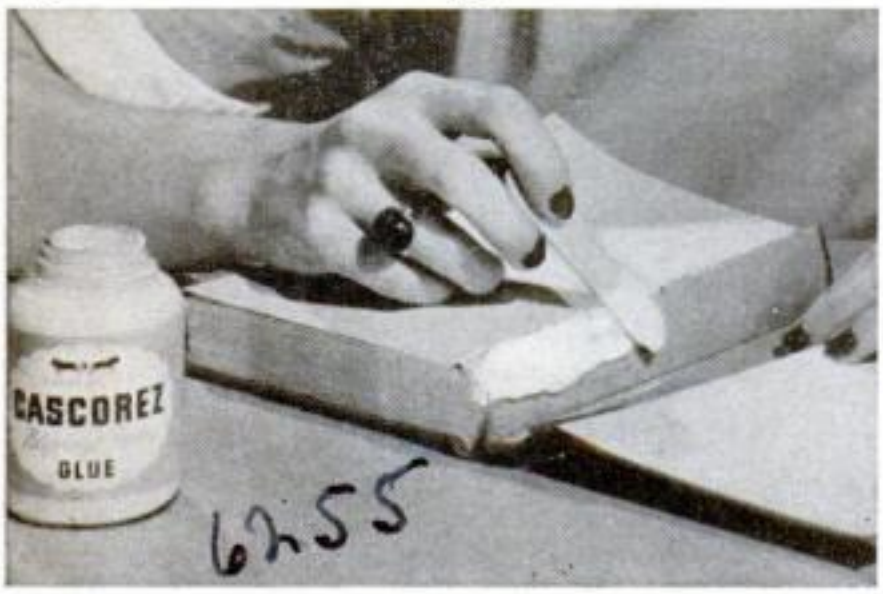
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Scale Support Hinged to Wall

A PIECE of wood, hinged to a barn wall or door frame, makes a handy support for weighing feed or chickens. When not in use, the bracket swings out of the way. Cut or saw a notch at the end for the scale hanger.—*Paul Criton, Jr., Kayville, Sask.*



Quick-Setting New Glue Is Clear When Dry



6255

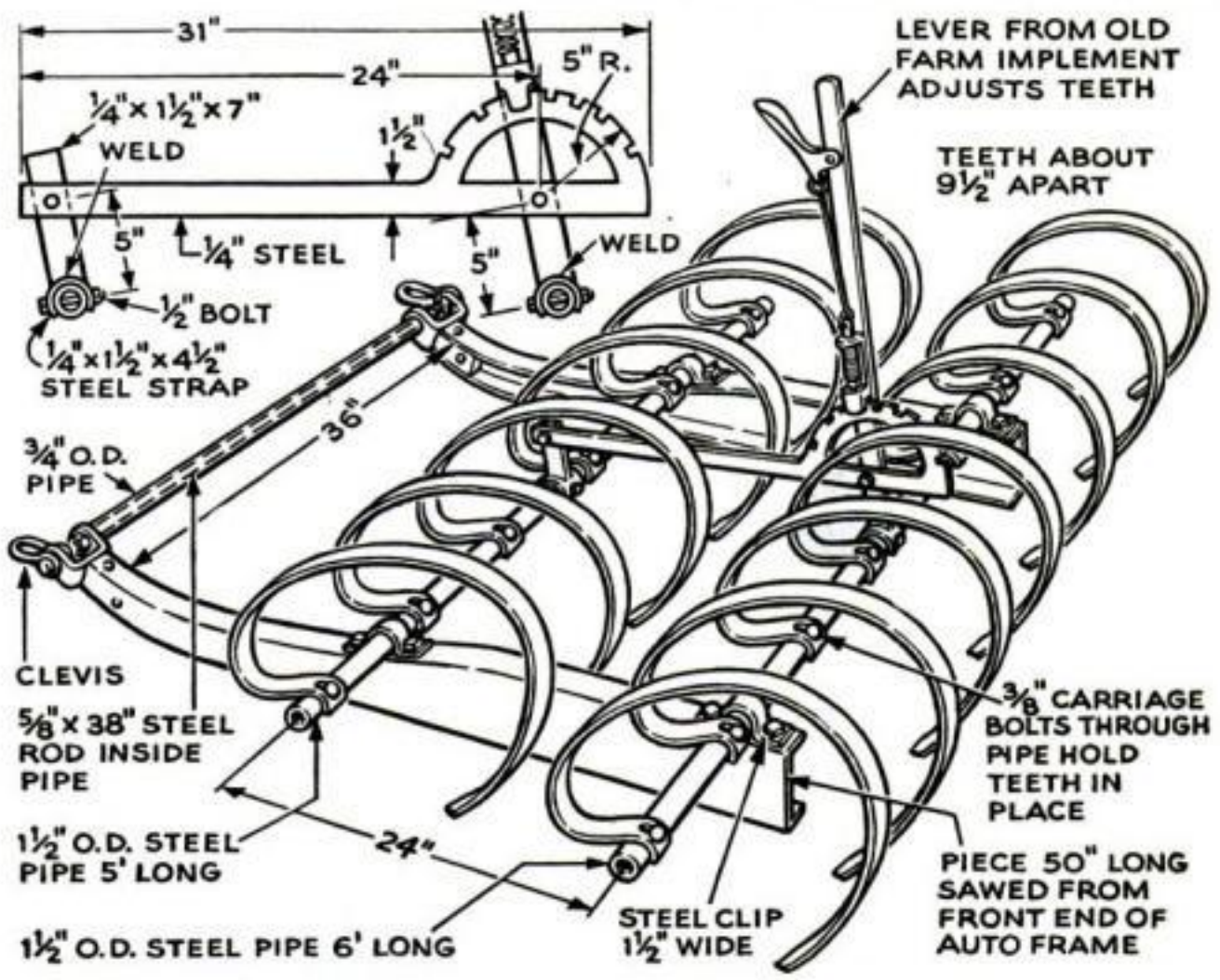
THIS new glue, Cascorez ®, looks like library paste and spreads as smoothly, but becomes transparent when dry. It sets in from 20 to 30 minutes on most woods, and almost instantly on balsa, cardboard, paper, and fabrics. Developed by the Chemical Division of the Borden Co., it was tested by technicians on typical home gluing jobs, including furniture construction, veneering, inlay work, and household repairs. The glue was first made for the lamination of auto safety glass.

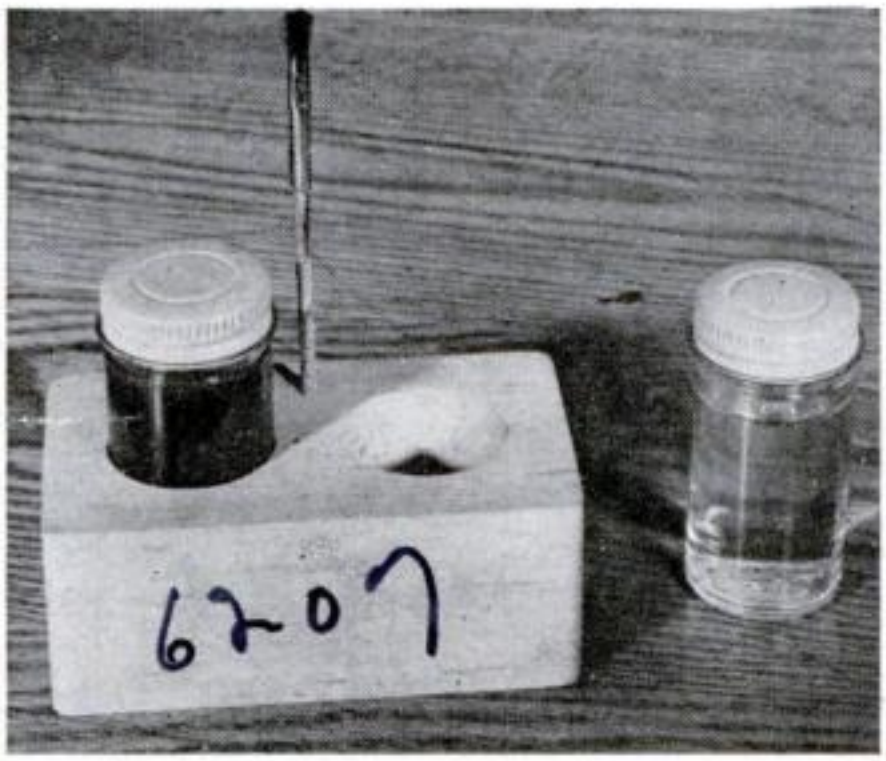
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Framework for Harrow Cut from Old Auto Chassis



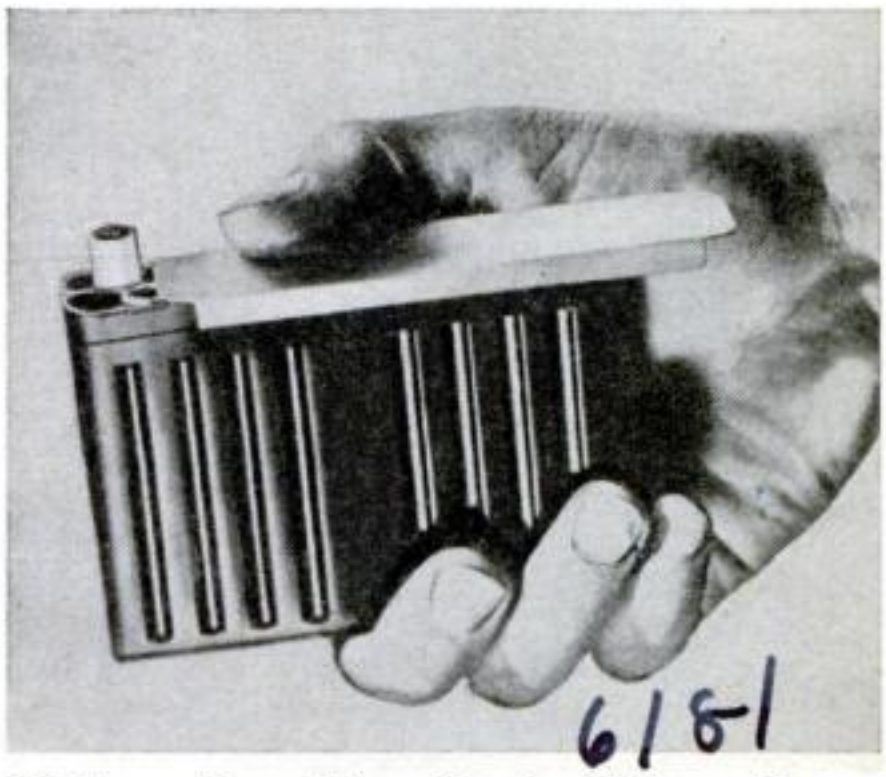
THE front section of an auto frame and two pieces of 1½" pipe form the base of this heavy-duty harrow built by Art Johansson, of Poulsbo, Wash. Note that the spring clevis left on each chassis piece was used to hold the spacer and steel rod. The teeth, taken from an old harrow, are set about 9½" apart with the center tooth of the rear row located on the centerline of the frame. Like the teeth, the adjusting lever was borrowed from an abandoned harrow (it could be cut from ¼" cold rolled steel). In attaching this mechanism, care was taken to mount both lever arms vertical to the frame when the tips of the teeth were level with the bottom of the runners. The drag chain is attached right to both clevises.—*Edward R. Lucas, Poulsbo, Wash.*





Gluewell Keeps Bench Neat

A COUPLE of small jars set in a block of wood can be temper savers. One jar holds glue and the other water. When you're gluing up small parts, put the brush in the water jar instead of laying it on the edge of the workbench. Then when you finish the job, stick the brush upright in its hole to dry, and screw the caps on the two jars.—*Herbert Pfister, Bronx, N. Y.*

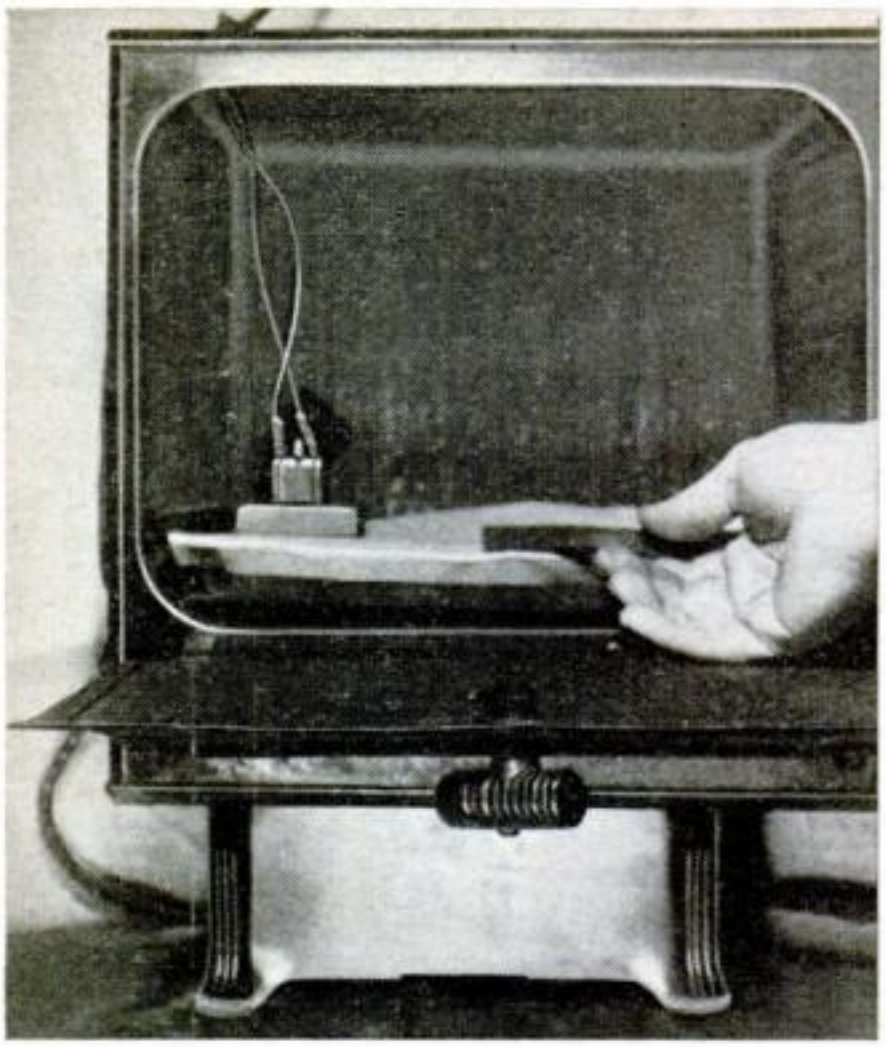


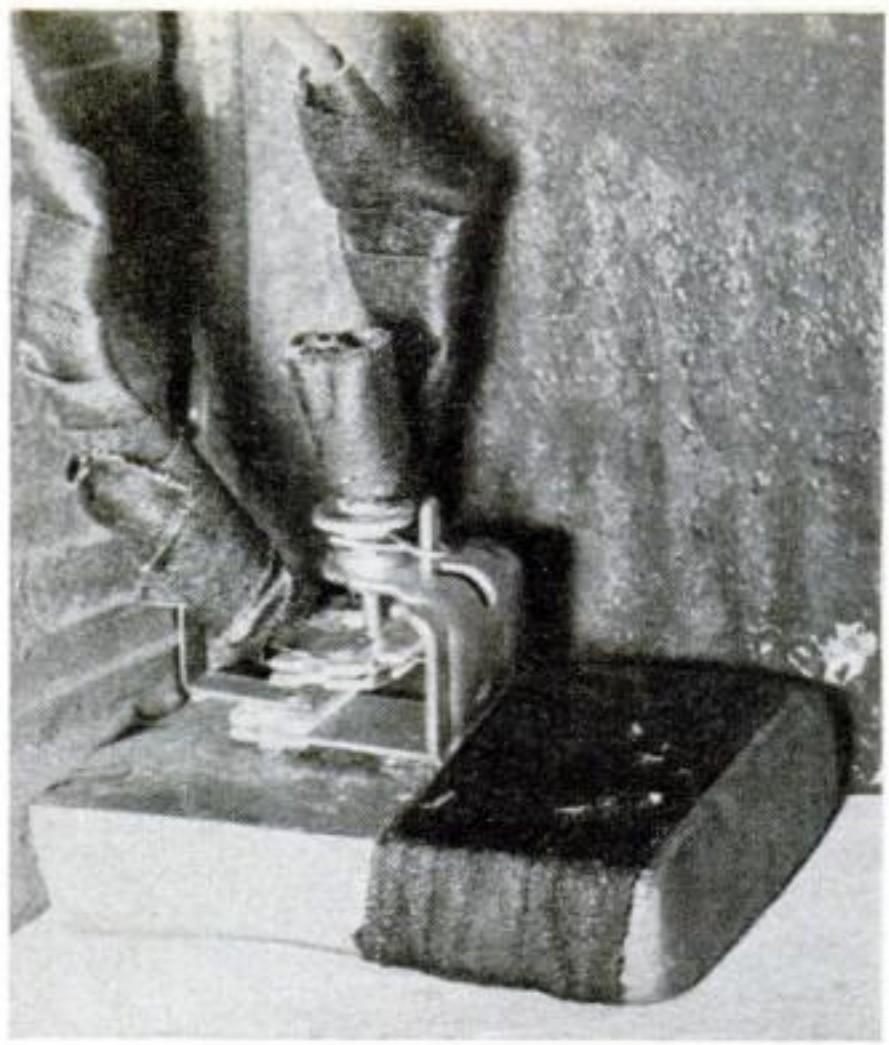
Cigarettes Pop Out of New Case

As THE chrome-plated top of this lightweight plastic case is slipped back, each cigarette pops up from its individual compartment. Rows are staggered, so one smoke is released at a time. The case, which holds a full pack, is manufactured by the Premier Plastic Corp., of Chicago, and is priced at about $2. It is available in black, emerald, or maroon.

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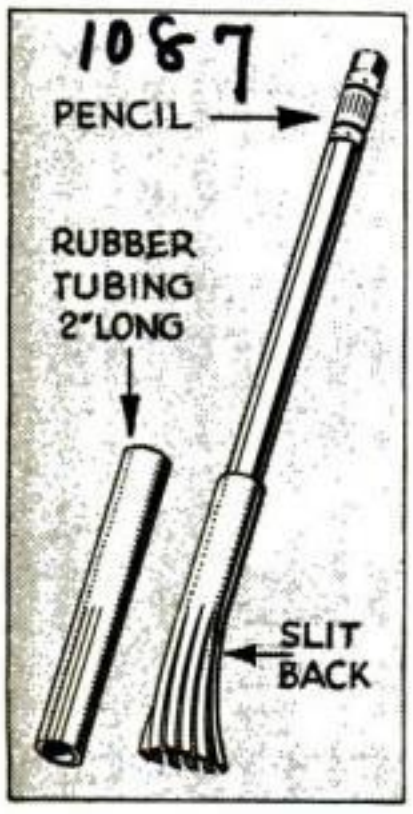
Electric Shop Oven Softens or Cures Plastic

You can soften thermoplastic in the kitchen oven, but trying to form it without the conveniences of your workbench will soon convince you that a shop oven would be a fine thing. I built an automatically controlled one for less than $7, of which $2 went for a used range-top oven and $3 for a new electric hot plate.

The oven is mounted with bolts and brackets so that no part of it touches the heating coil. Temperature is controlled by an adjustable thermostat of the kind used in electric irons. This turns the current on or off to maintain any preset heat for shaping or curing plastics. It pays to buy an oven thermometer (they cost only a few cents) for setting the thermostat. Mount the thermometer well inside.

Place an asbestos pad in the bottom of the oven to protect the control element from the direct heat of the coil. Otherwise it won't respond to the true oven temperature. You can fasten the 'stat to an asbestos block with friction tape, but bolts make for a more permanent job. Cut one of the two wires leading to the hot plate apart, and connect the cut ends to the two thermostat terminals. To avoid shocks, wrap all exposed electrical contacts well with tape.—*Thomas A. Dickinson, Los Angeles.*

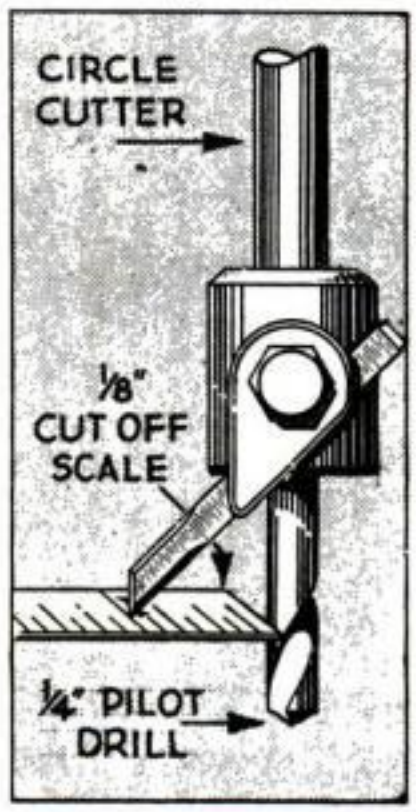
Slit Hose Forms Glue Brush



NEEDING a glue brush that had vanished from my cellar bench, I made a hurry-up substitute that proved so good I'm still using it. A 2″ length of soft windshield wiper hose was partly slipped on an ordinary lead pencil. Then 1″ of the hose was slit into strips 1/16″ wide with scissors.—*George Predential, Schenectady, N.Y.*

Doctored Rule Sets Fly Cutter

A FRAGMENT of an old steel rule or tape will help you set an adjustable hole cutter right the first time. Measure the shank of the pilot drill. Then grind an amount equal to half the shank diameter off the end of the rule, shortening the first inch. Read settings right off the shortened rule as at right.—*Carl F. Bareis, Philadelphia.*



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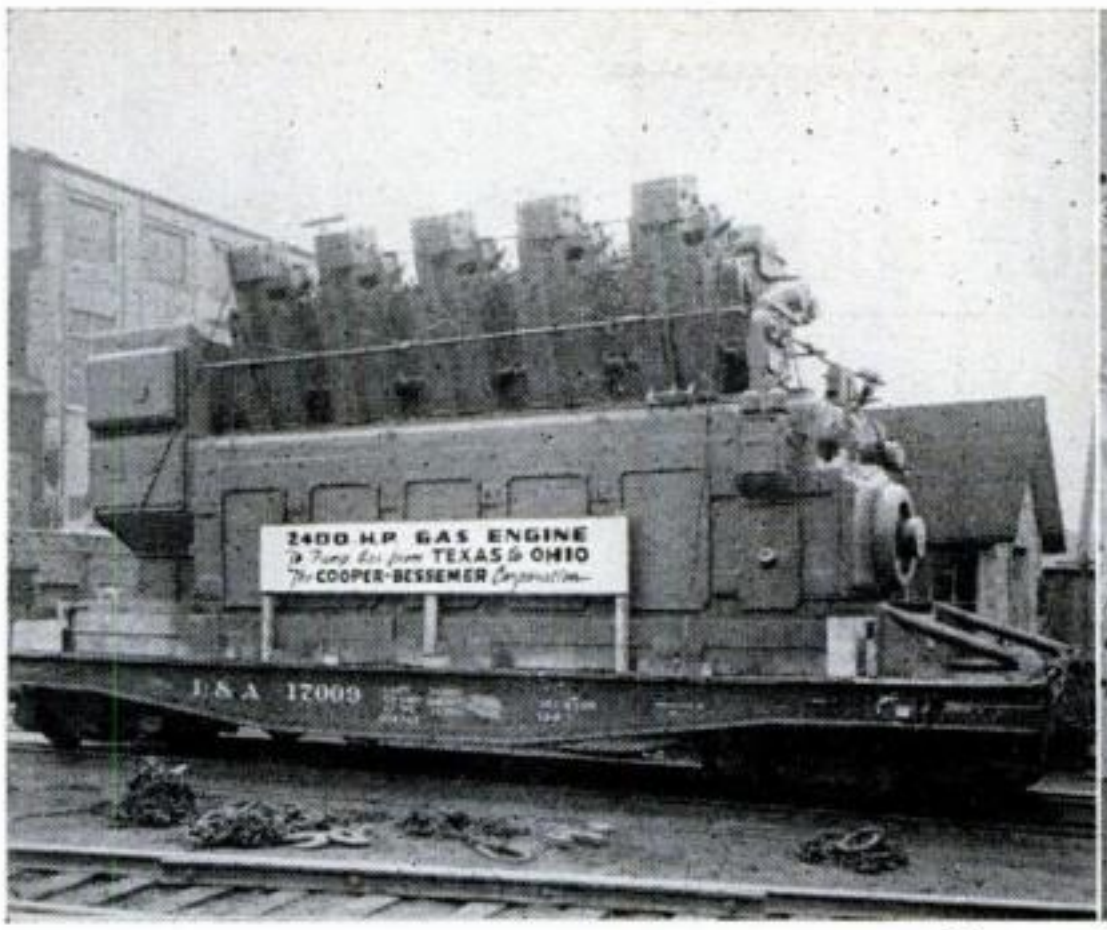
Weather-wise ducks are flying south, and weather-wise motorists are installing new dependable Champion Spark Plugs. It's the best, most economical insurance of snappy winter engine performance if new ones are needed. New Champions insure quick starts, minimum battery drain, and better gas mileage all winter long, when gas consumption is usually up. Insist on dependable Champions—America's Favorite Spark Plug—because they're tops in quality, value, performance and dependability. A quacking duck poster will remind you—"HERE COMES WINTER!" Champion Spark Plug Company, Toledo 1, Ohio.

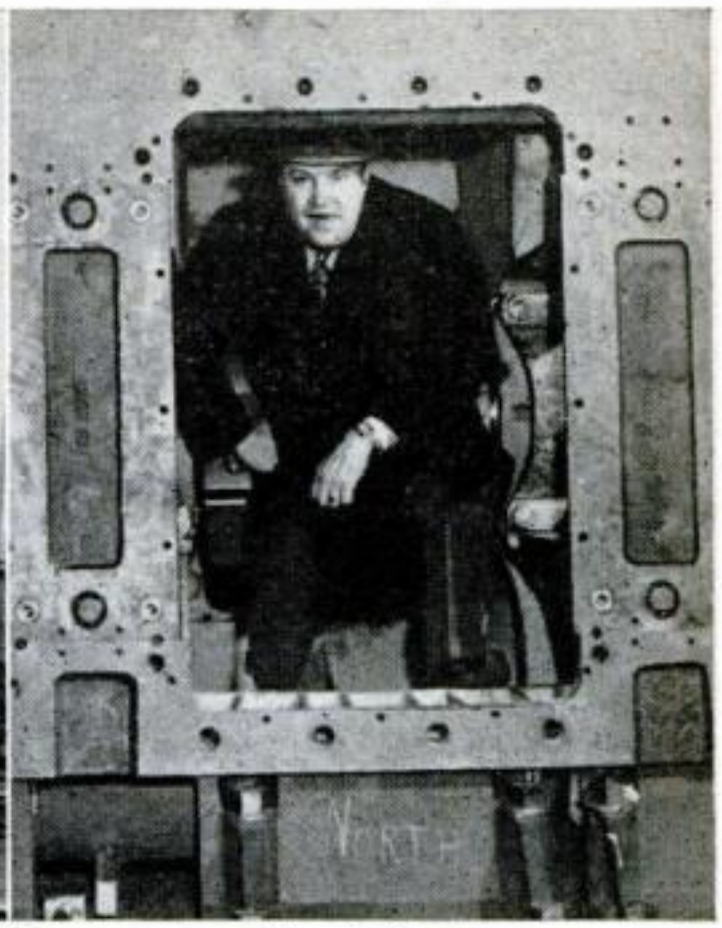
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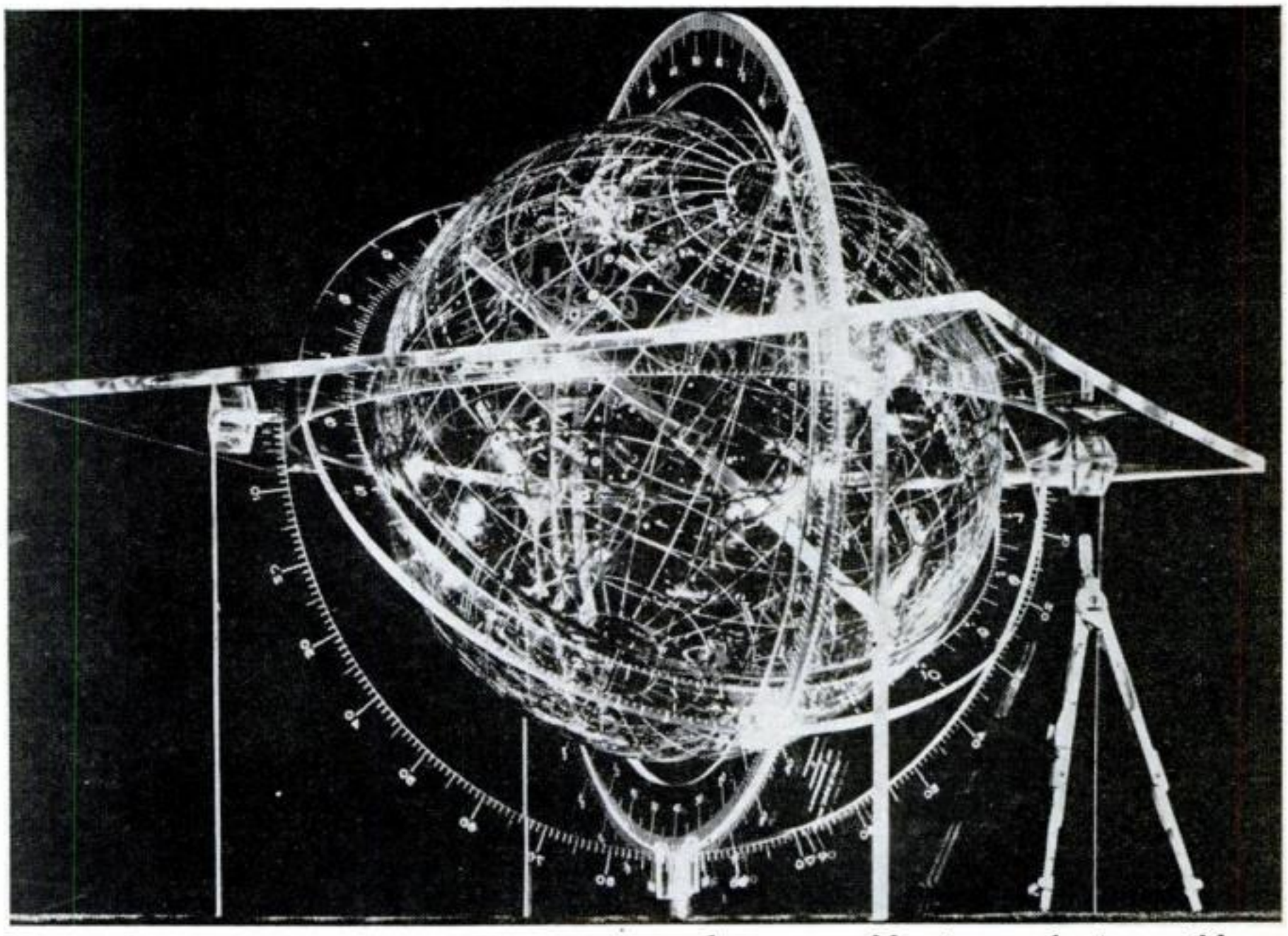
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Globe Aids Star Study

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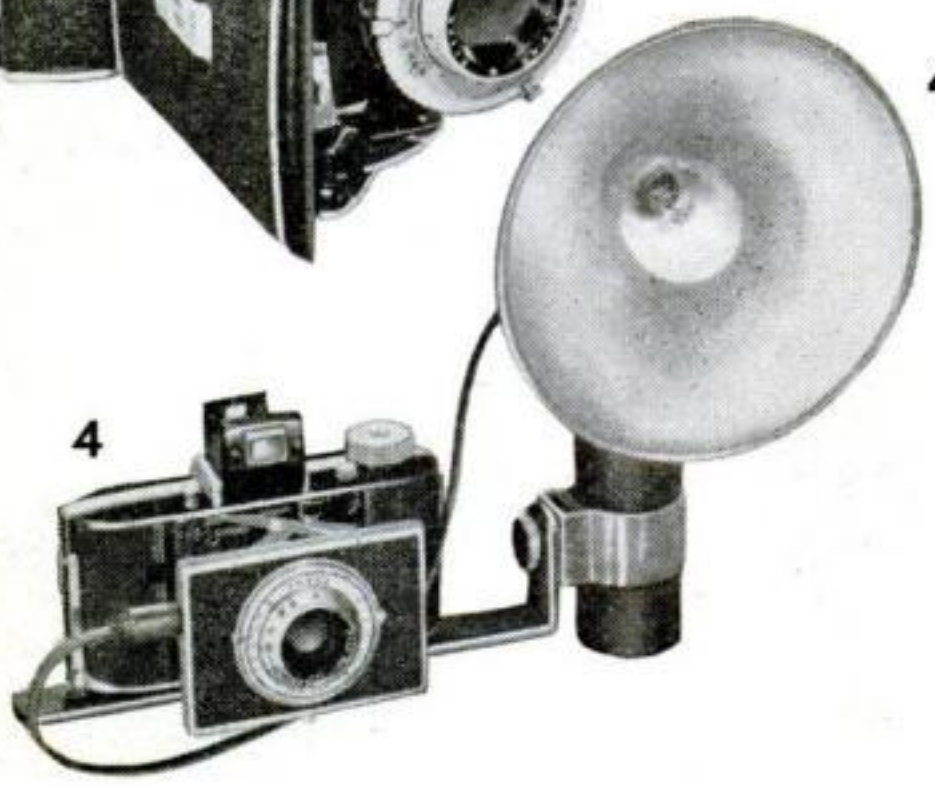
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2



3



4

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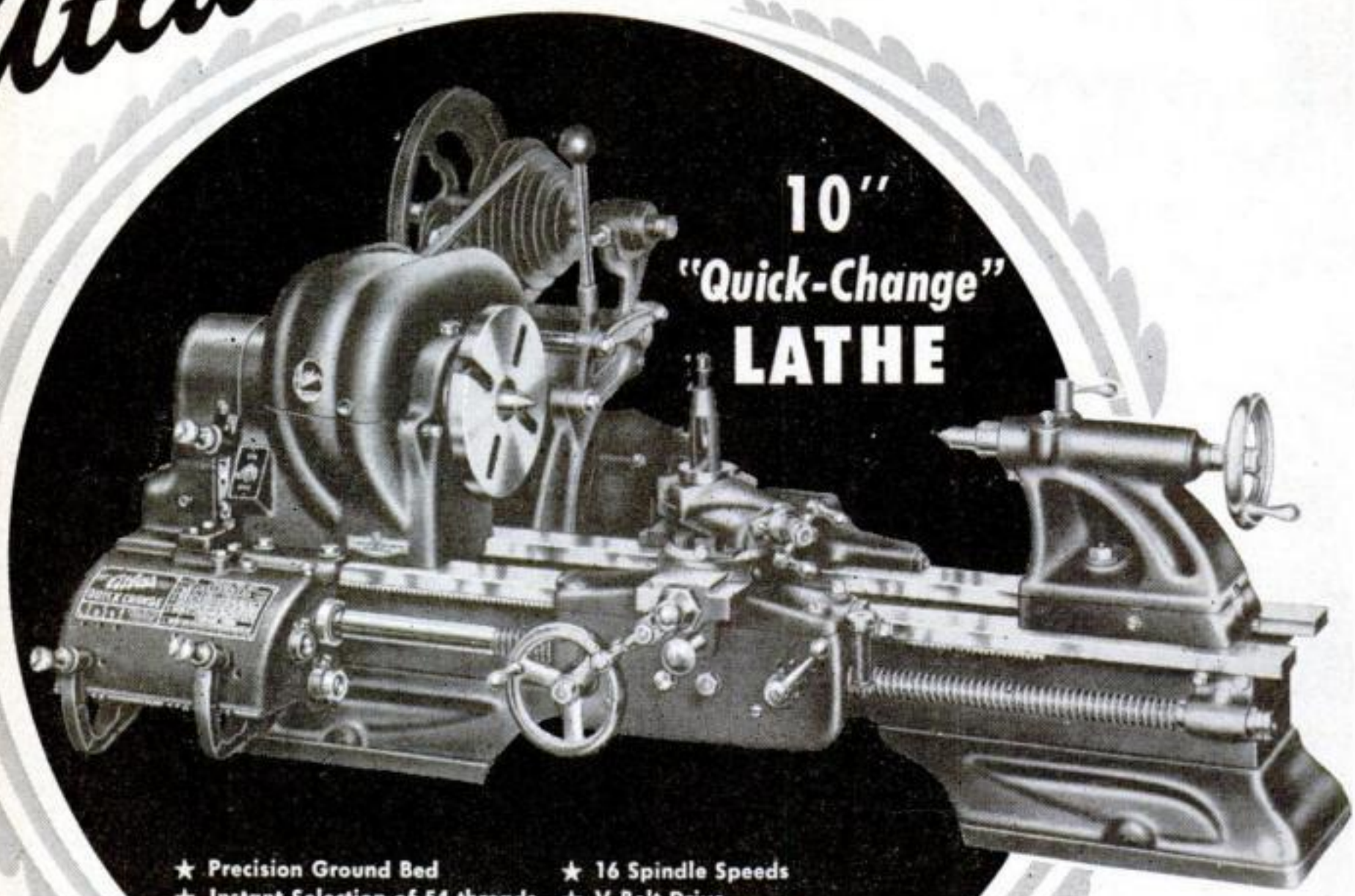
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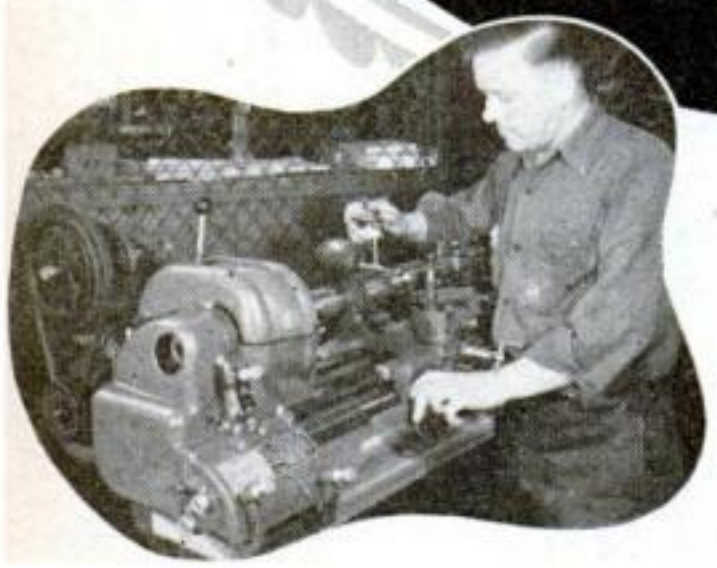
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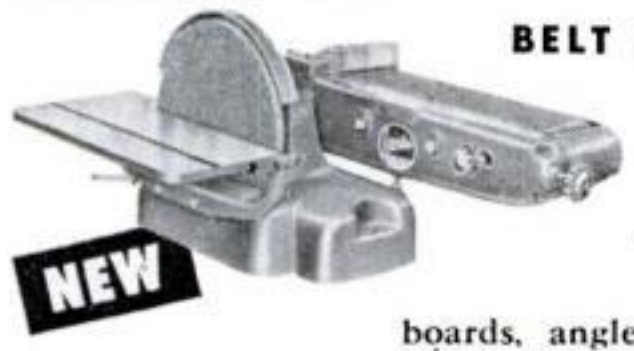
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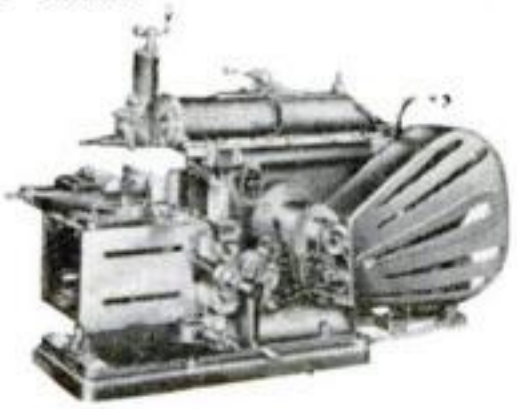
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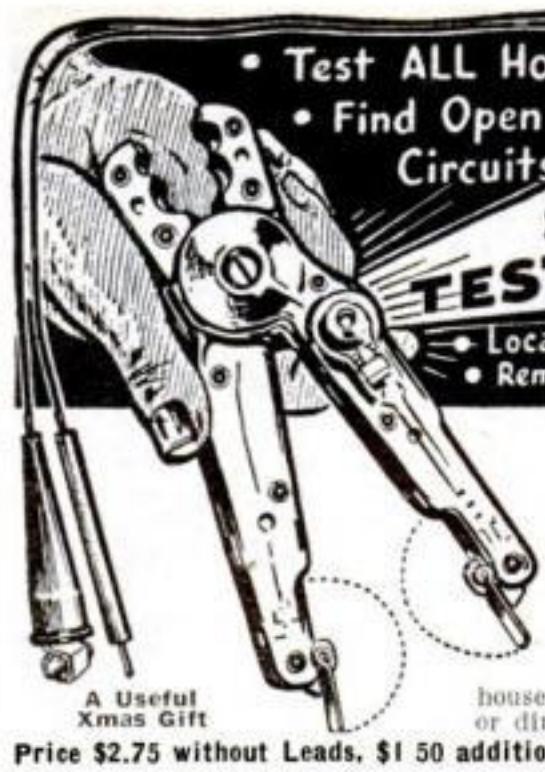
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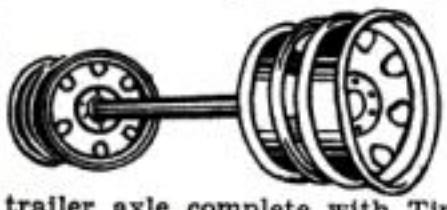
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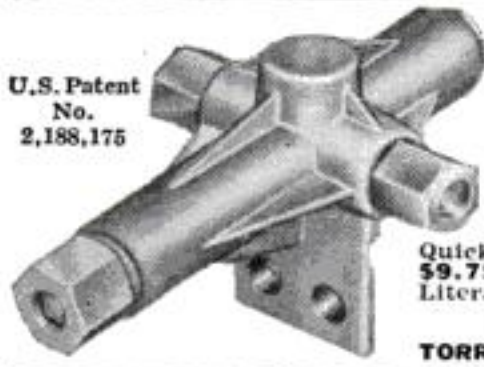
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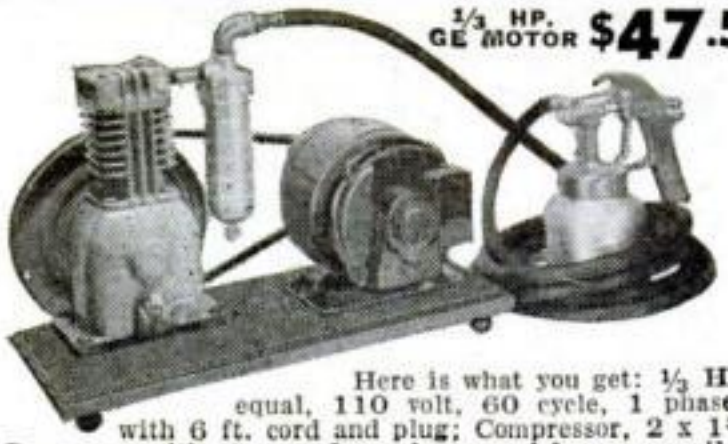
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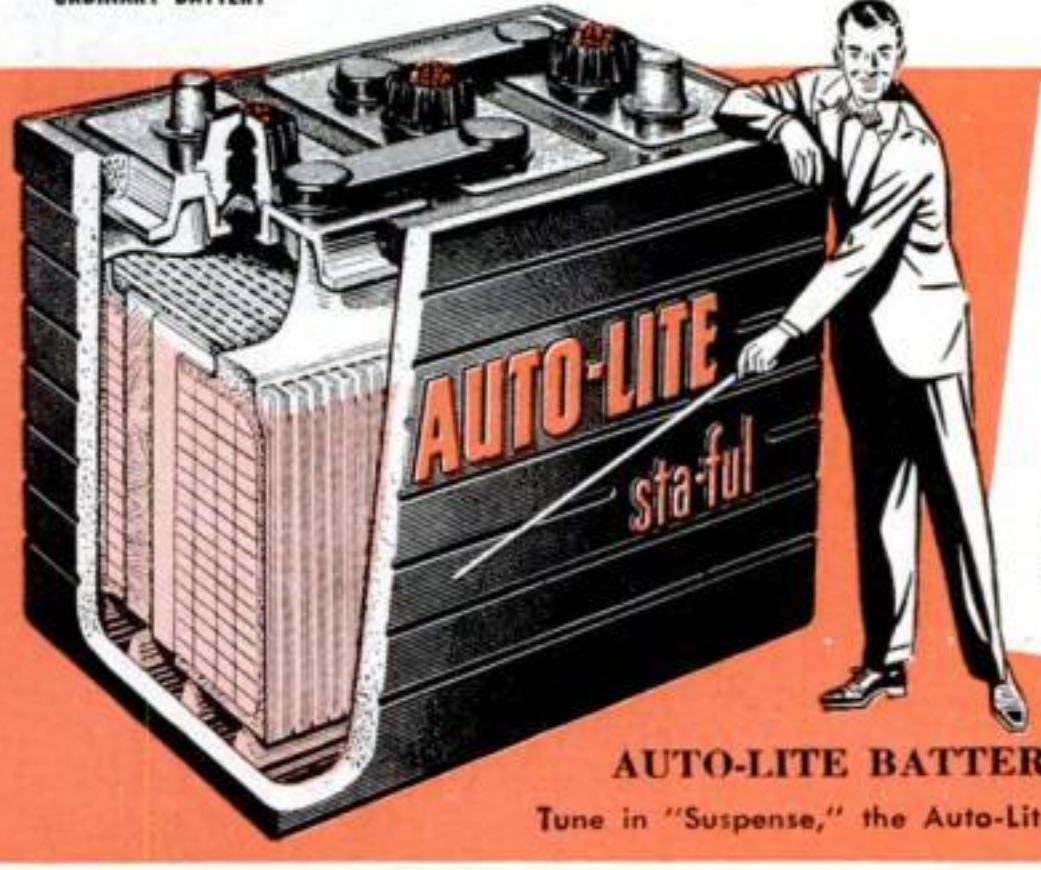
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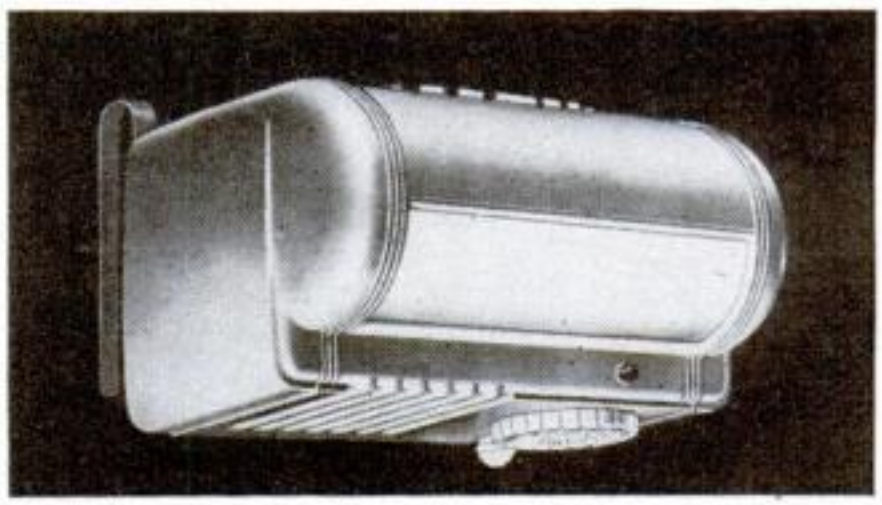
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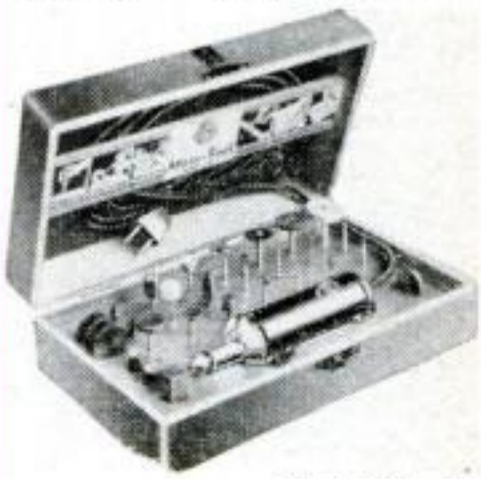
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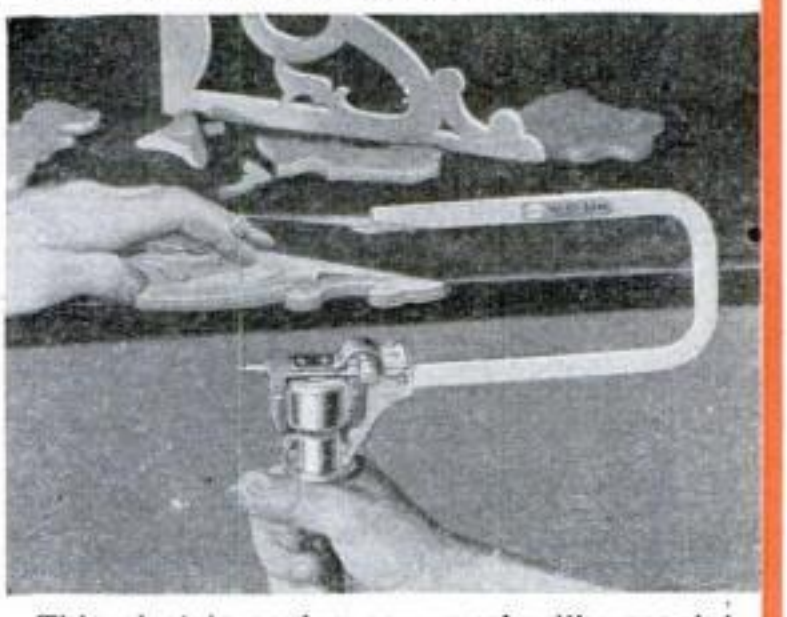
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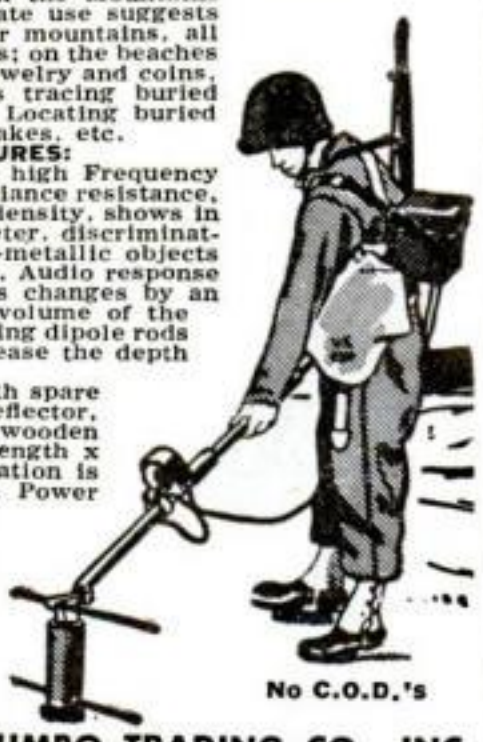
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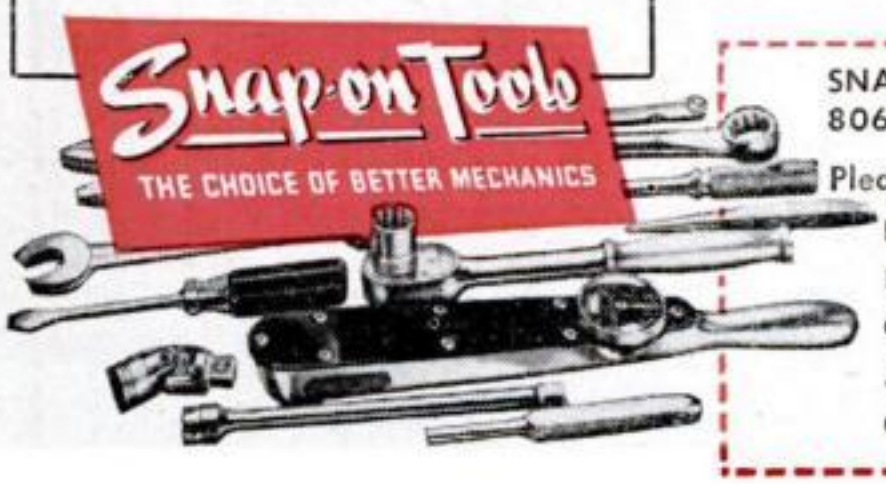
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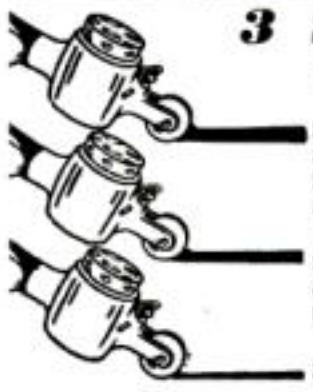
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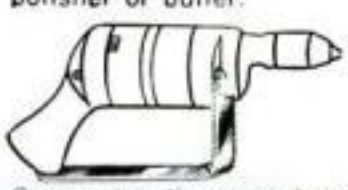
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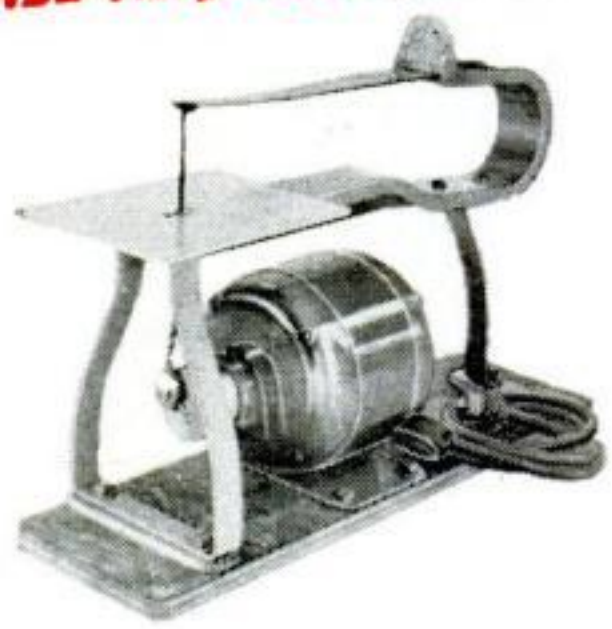
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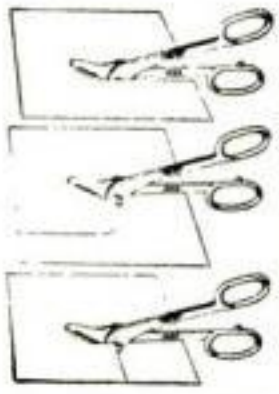
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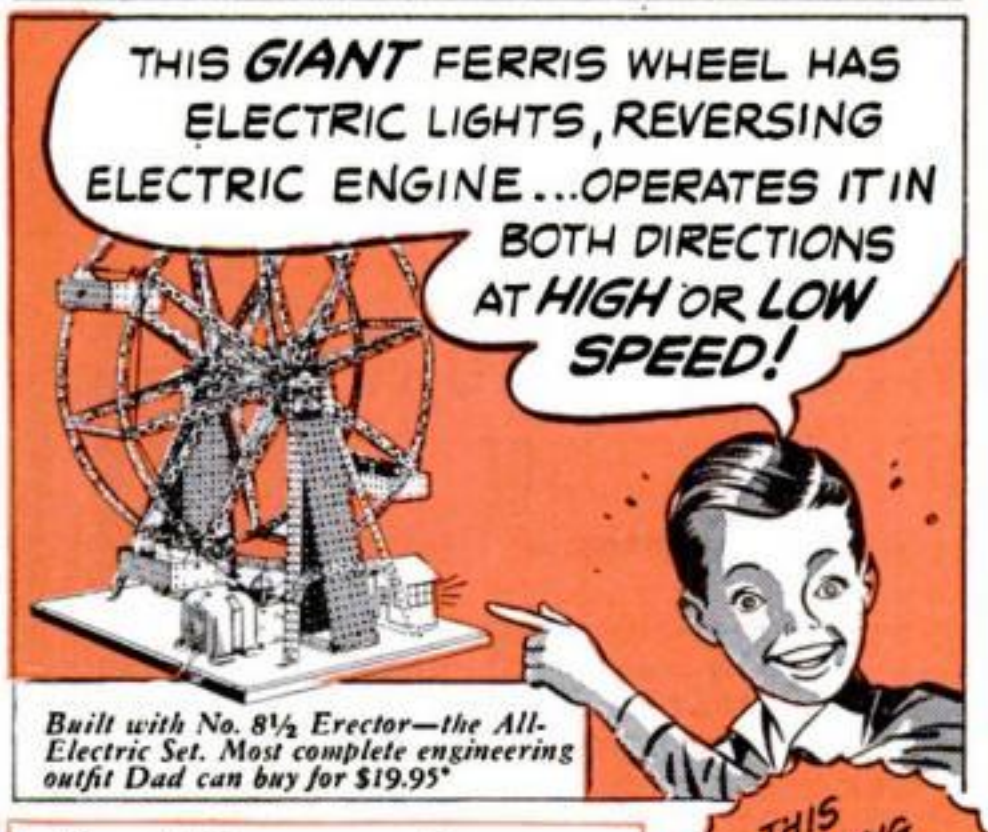
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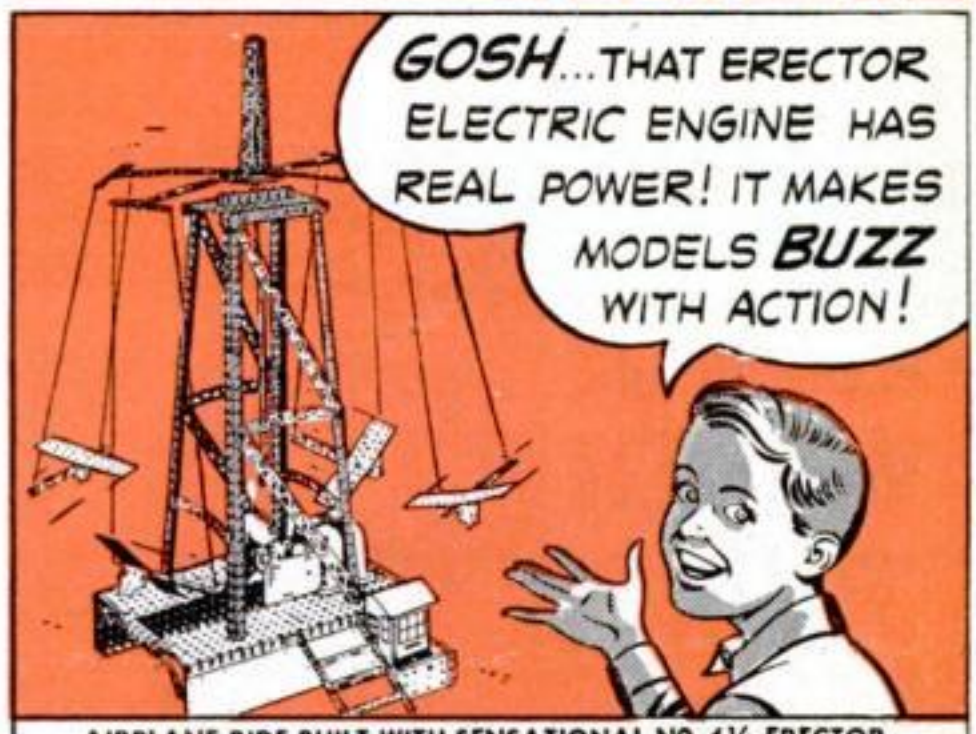




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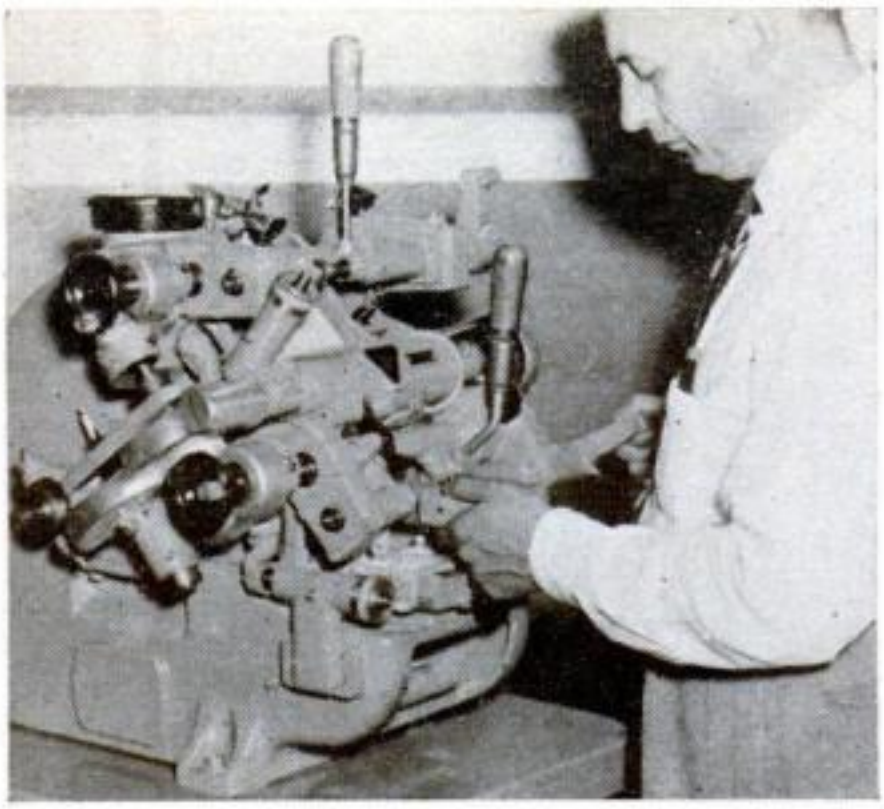
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WIDELY scattered logging teams in the Canadian wilds are using two-way, portable radios to warn each other of storms and forest fires, get weather forecasts, and report their progress to the mill. Made by GE, the 60-watt, FM radios consist of a transmitter and receiver shock-mounted in small wardrobe trunks. Nine units are now in use.

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Complete with pulley and mounting brackets, ready for use.

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An extraordinary value for all types of intermittent or continuous pumping in the home . . . farm . . . factory. Built to exact specifications of Packard Motor Car Co. for use in Rolls-Royce Merlin Aircraft Engines. May be run with electric motor, gas engine or power take-off on tractor. Delivers up to 25 gallons a minute with 1/4 H.P. motor: 80 gal. a min. with one H.P. motor. Will deliver up to 44 ft. head or 25 ft. suction. Use 1" outlet hose; 1" or 1½" inlet hose (recommended).

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Has cast aluminum housing, accurately machined 5" bronze impeller; 3½" V belt pulley and mounting brackets. Shaft rotates on ball bearing; has grease gun fitting.

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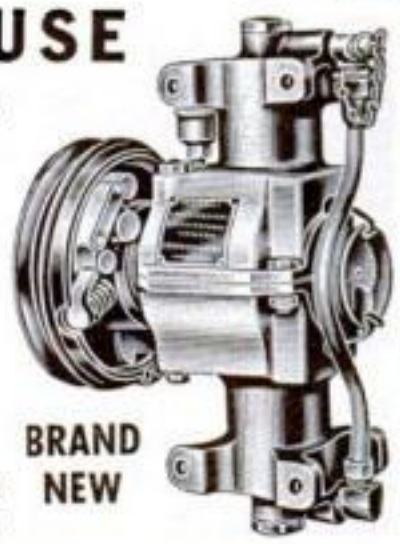
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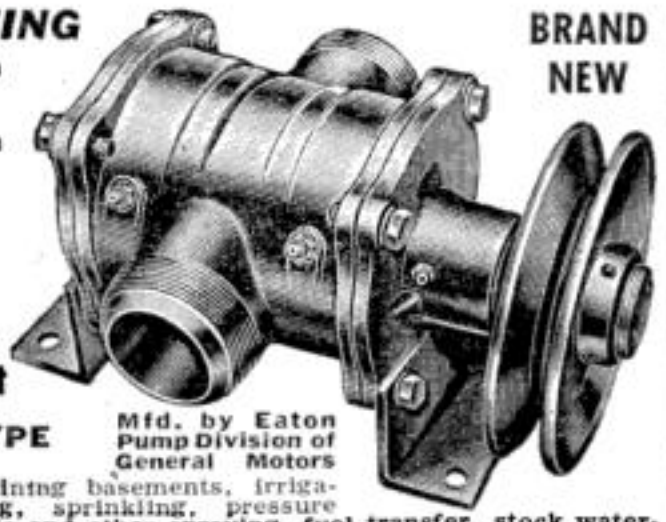
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GEROTOR TYPE

Mfd. by Eaton Pump Division of General Motors

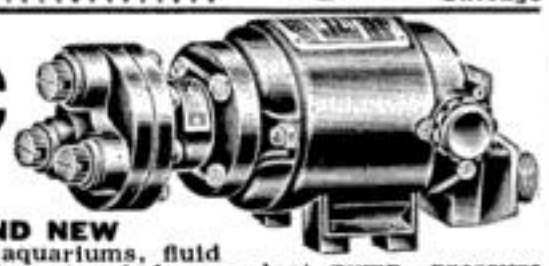
Perfect for draining basements, irrigation, **fire fighting**, sprinkling, pressure **booster, insecticide and other spraying**, fuel transfer, stock watering, **industrial pumping, deep well jet pumping and home water systems. Rated 25 ft.** suction and **100 ft.** head pressure at 65 gallons a minute with 1725 RPM at **one H.P.**

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Applications: oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc.

Motor mfd. by Black & Decker; double ball bearing series wound, continuous duty, 1/30 H.P. electric motor, rated 12,000 R.P.M. Transformer included for use on 110 V AC current. Also applicable for 24-32 V DC.

Pump mfd. by Weldon Tool Co. with standard ¼" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder.

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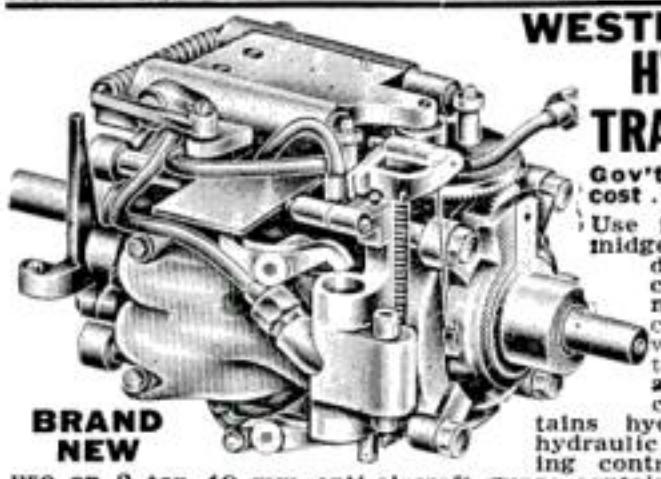


Three independent pump sections running off of one shaft, for single or multiple pumping. Use one as a vacuum pump capable of drawing 25 inches of mercury. Use one or two as a liquid pump for hydraulics, insecticide spraying, pond and basement draining, stock watering, aeration, etc.

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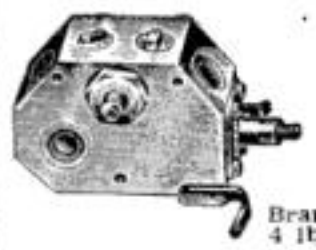
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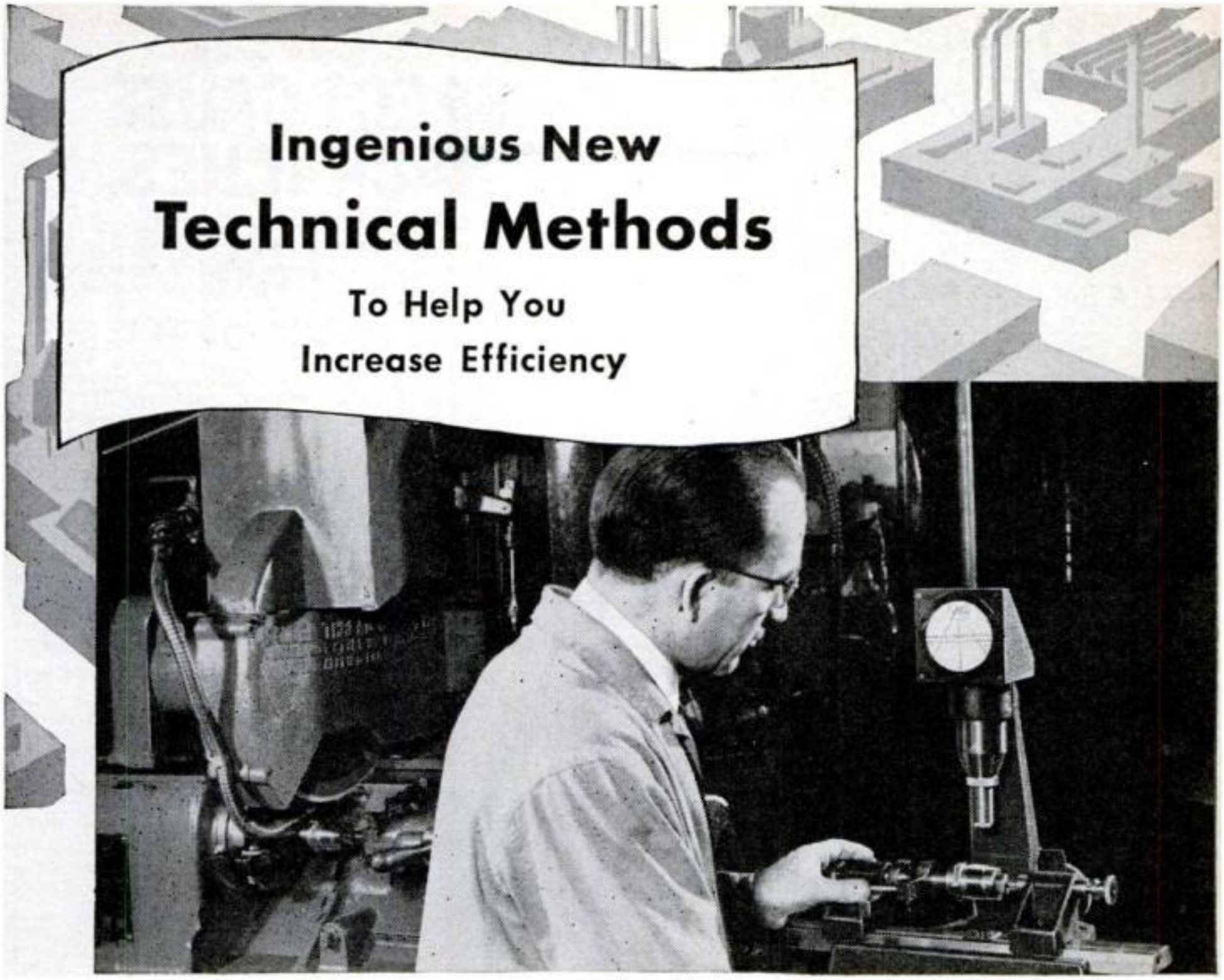
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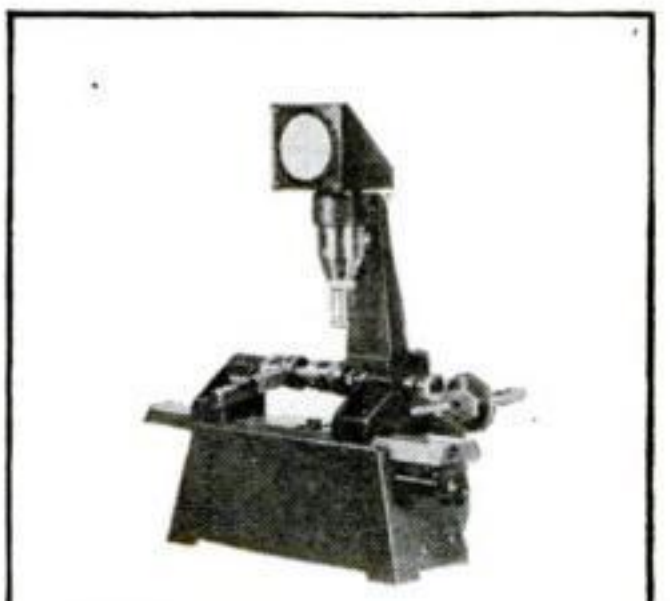
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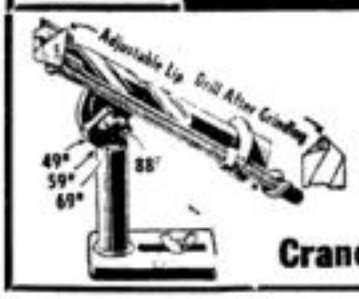
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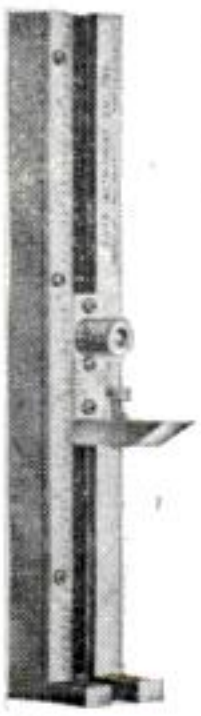
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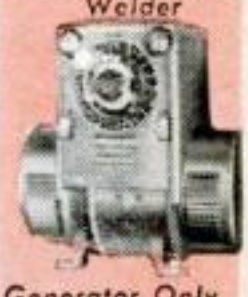
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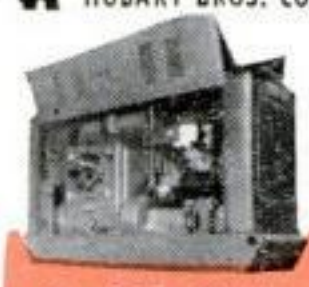
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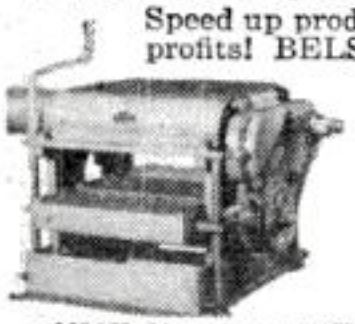
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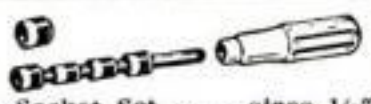
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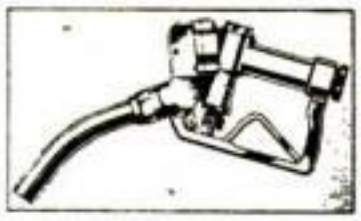


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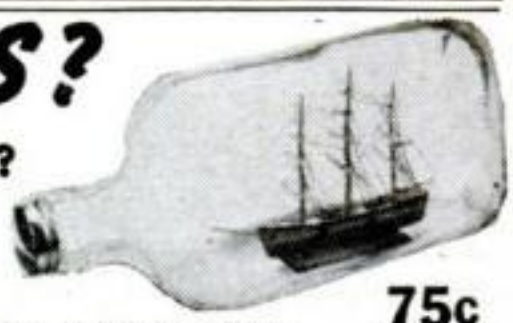
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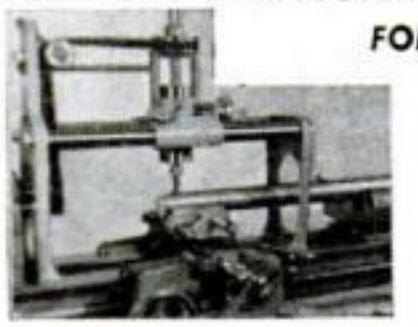
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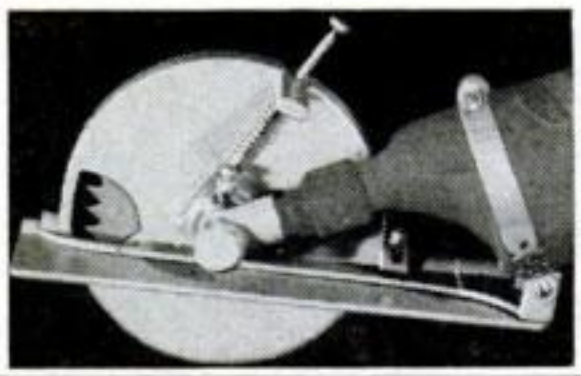
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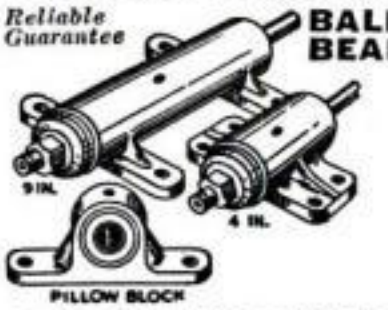
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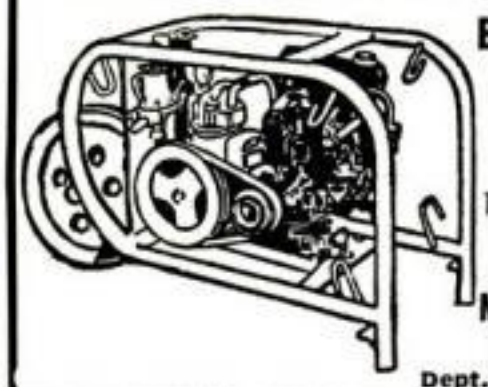
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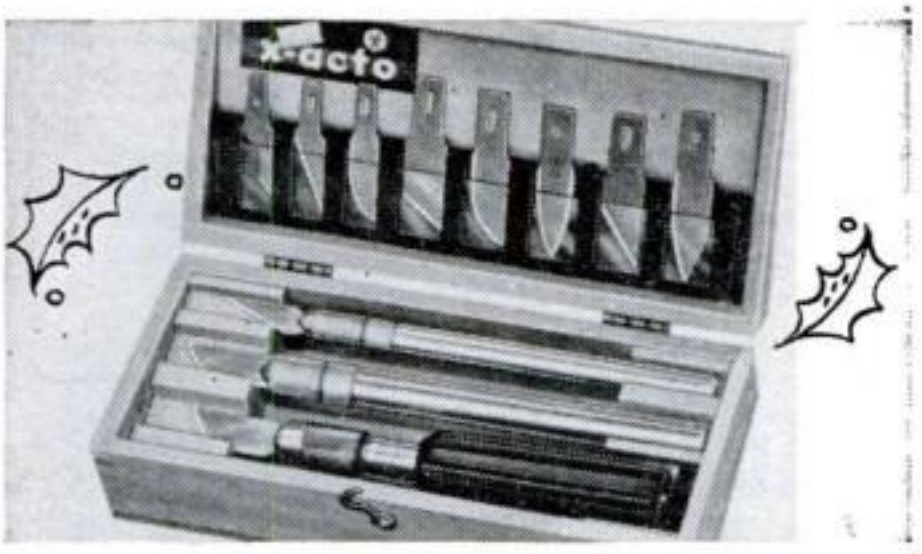
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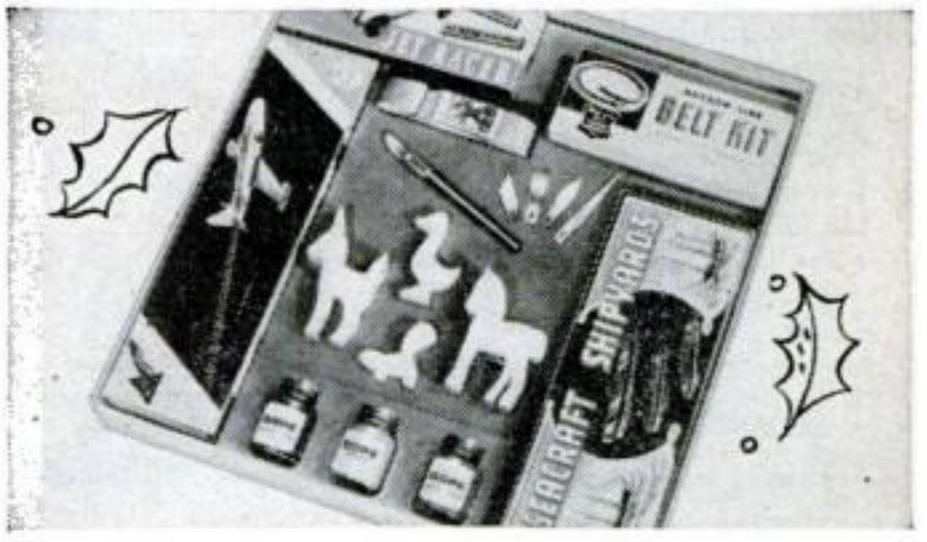
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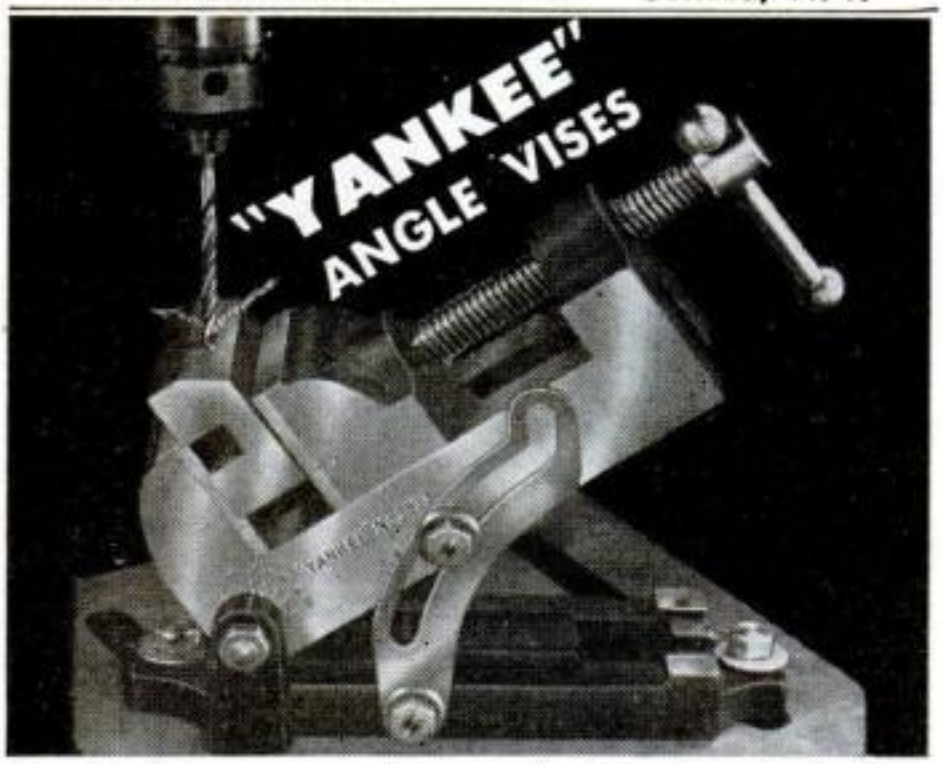
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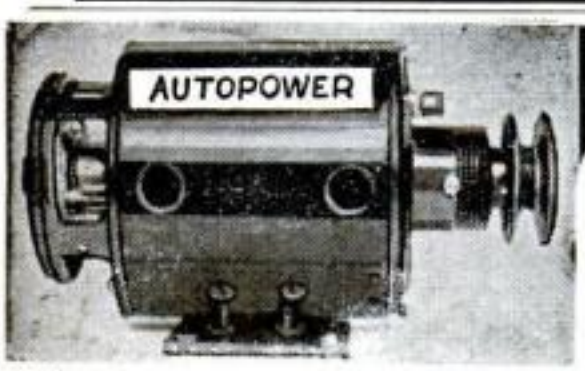
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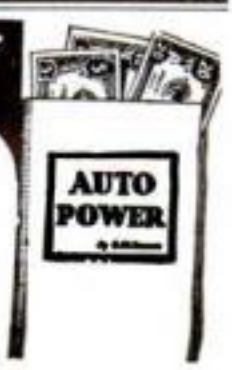
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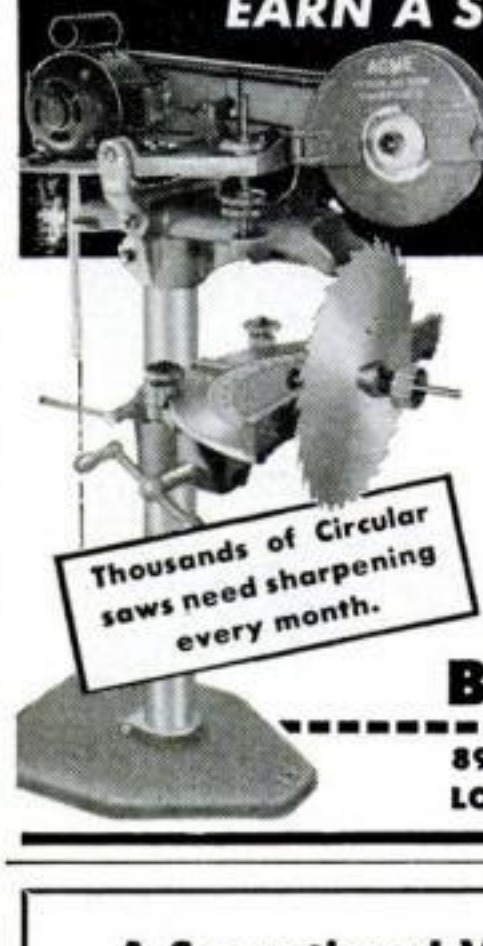
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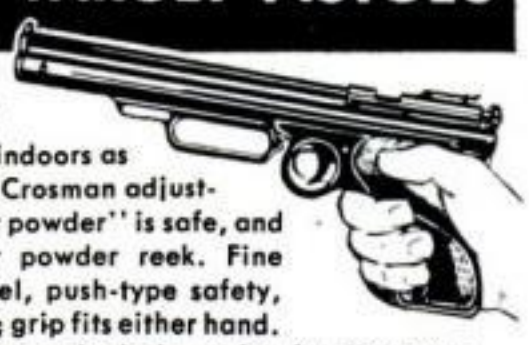
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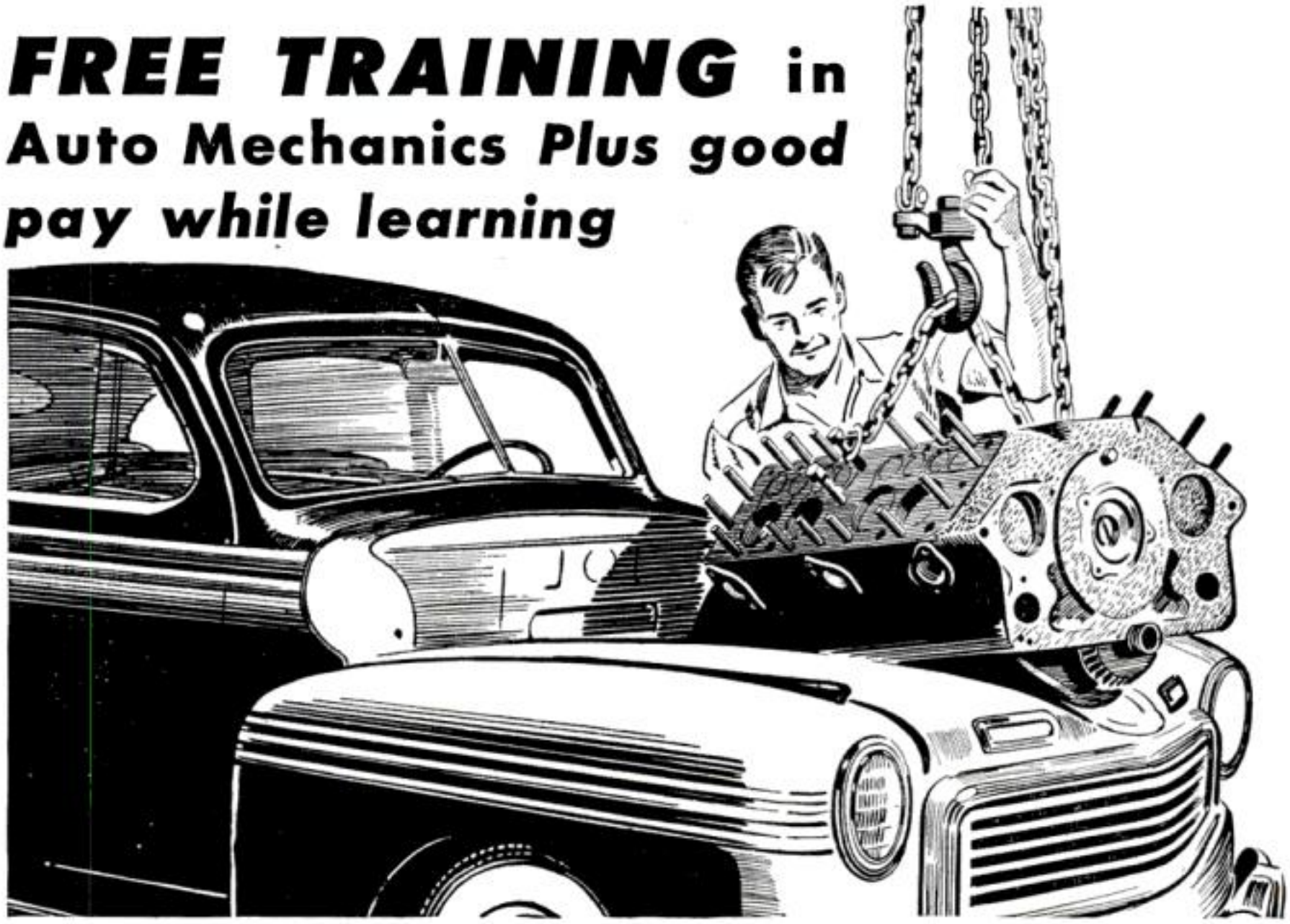
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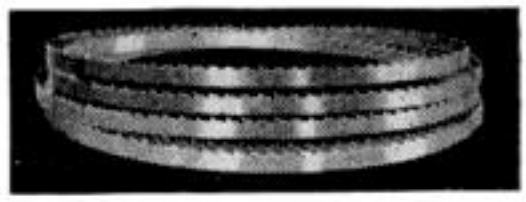
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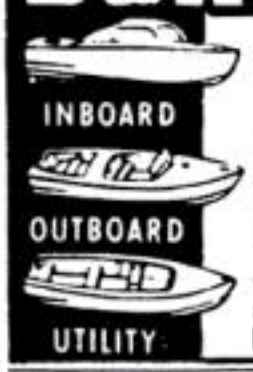
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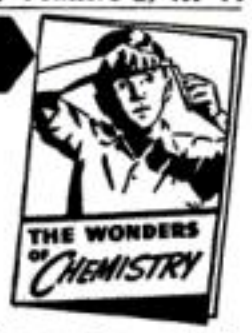
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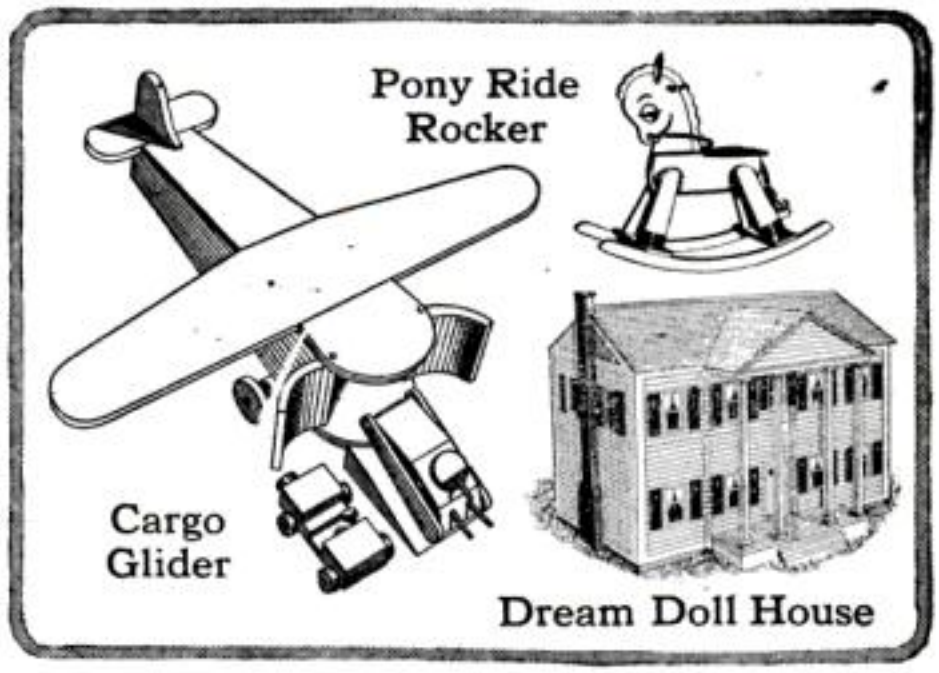
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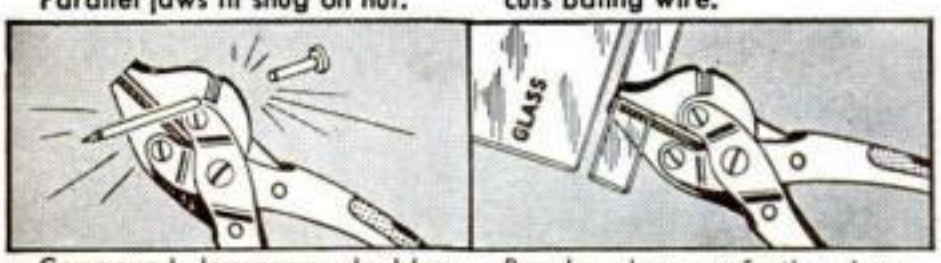


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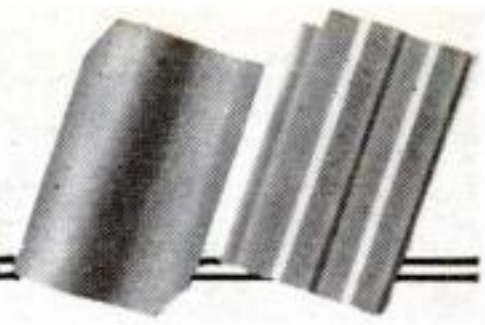
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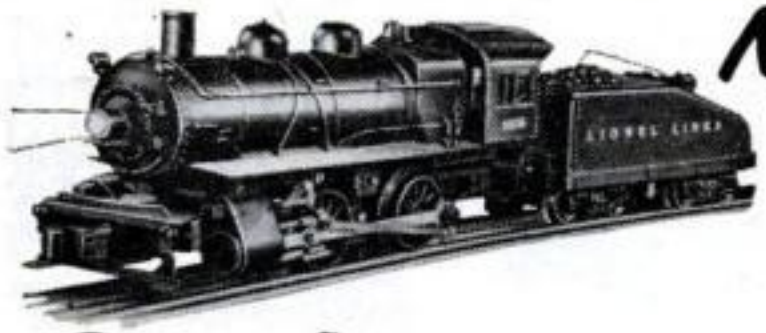
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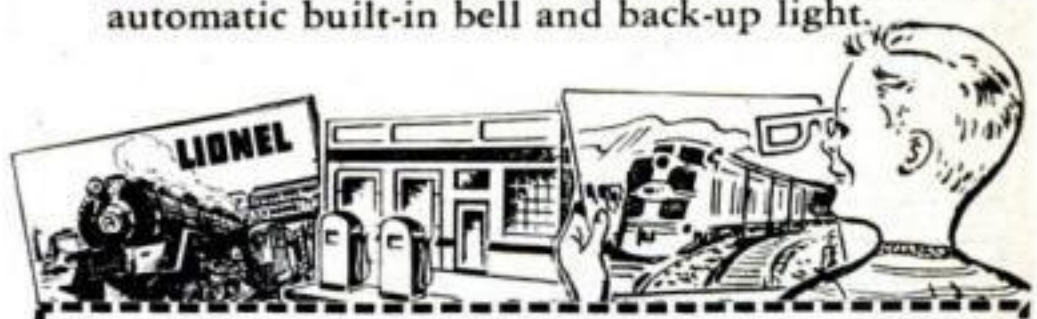
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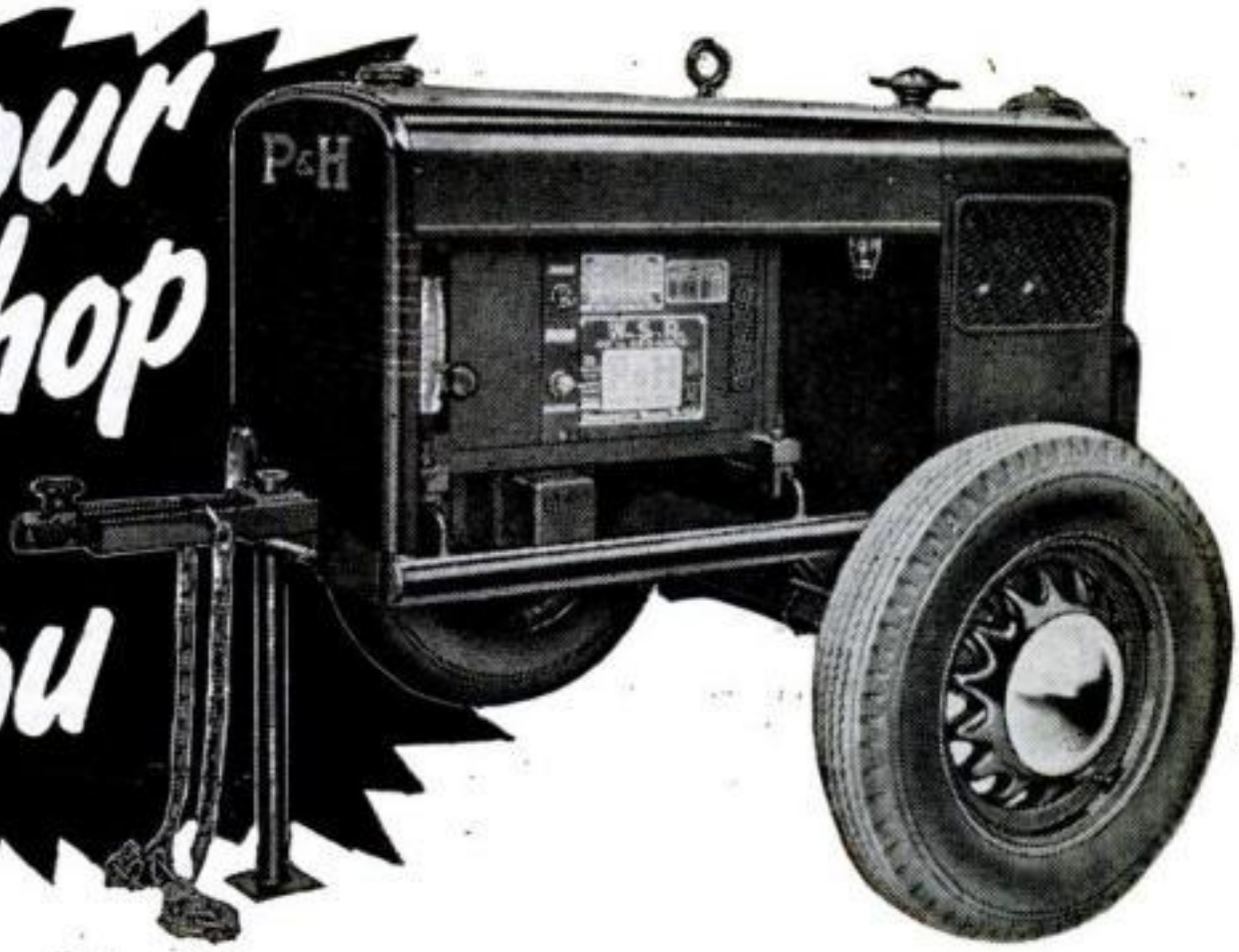


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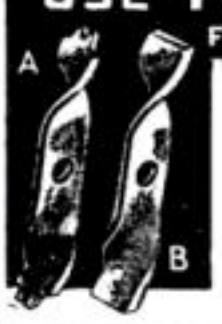
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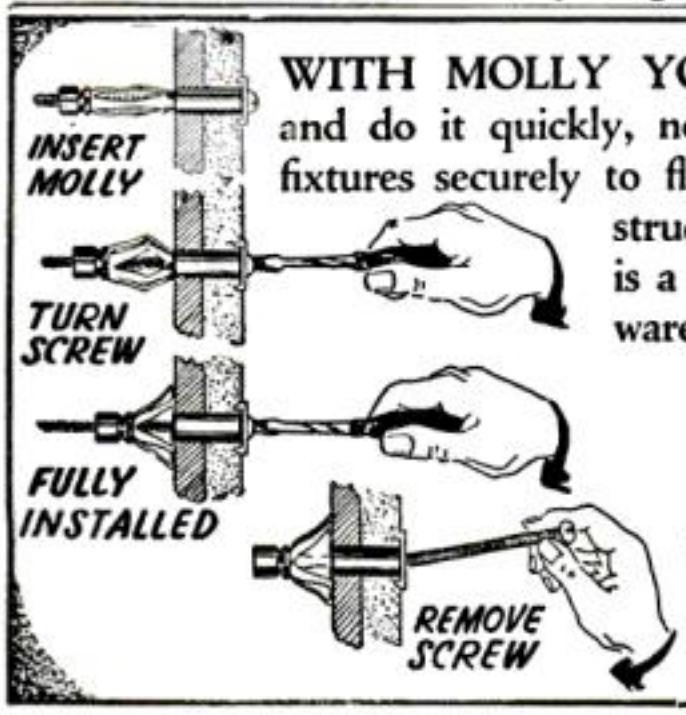
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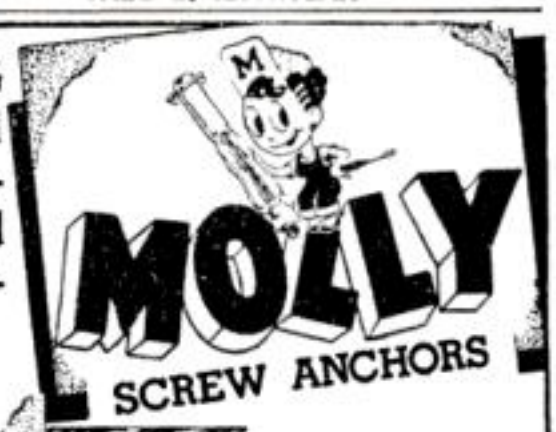
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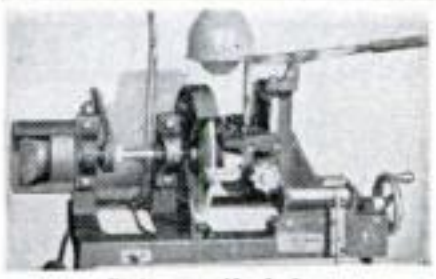
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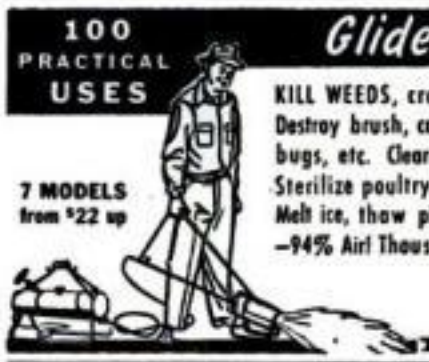
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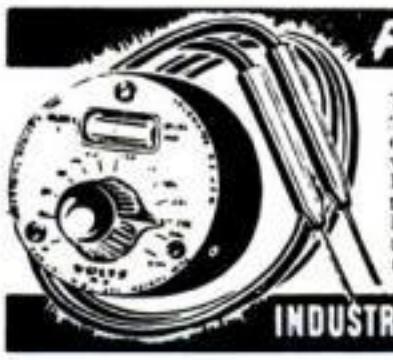
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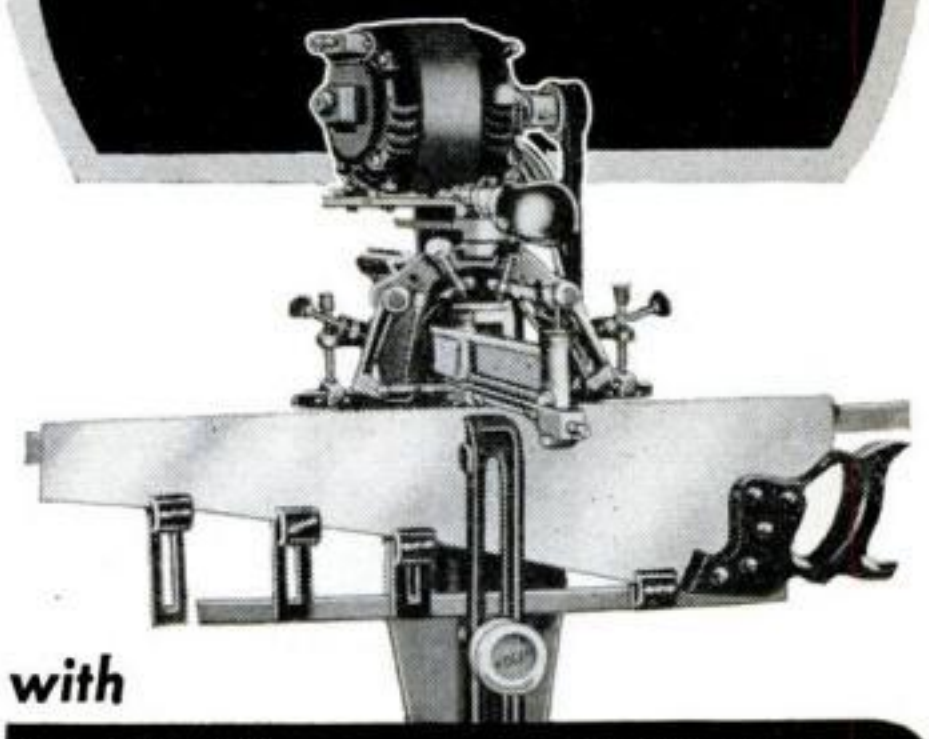
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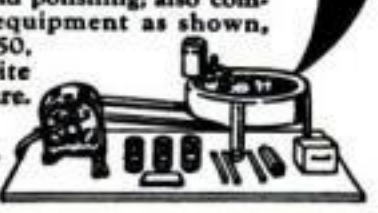
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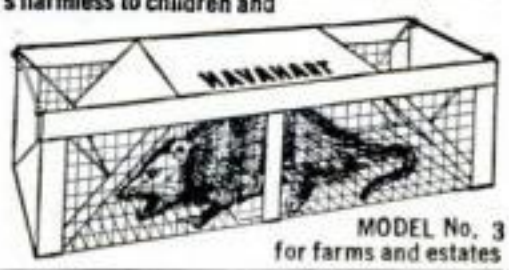
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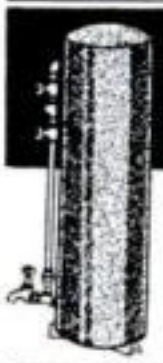
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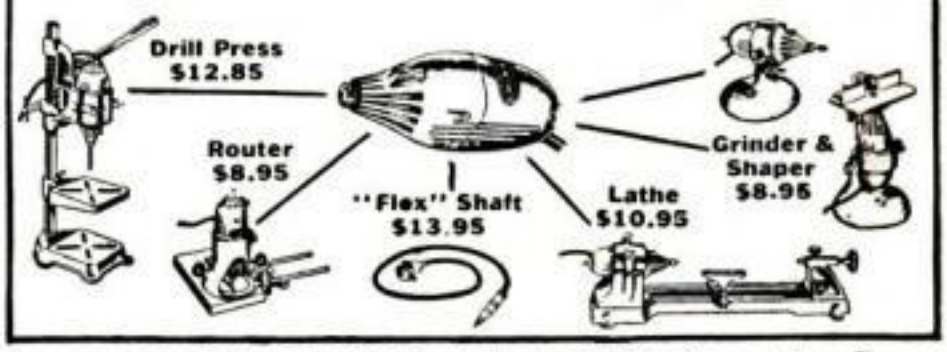


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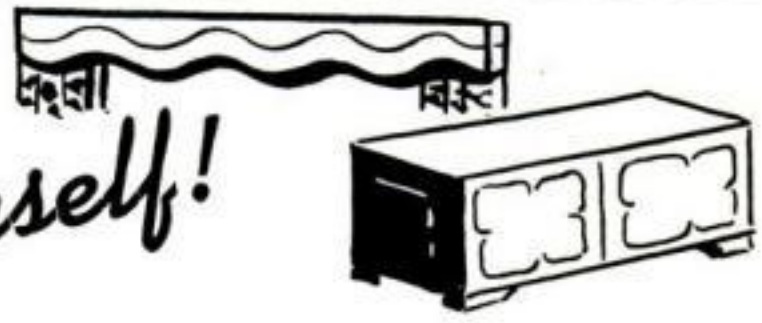
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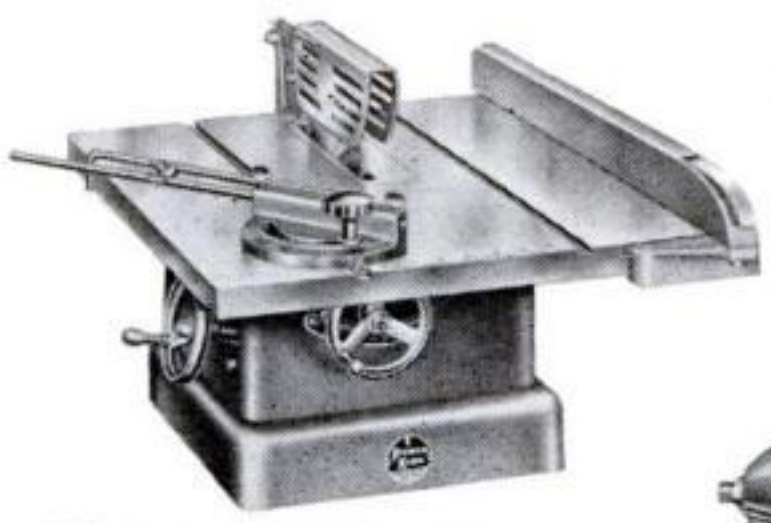


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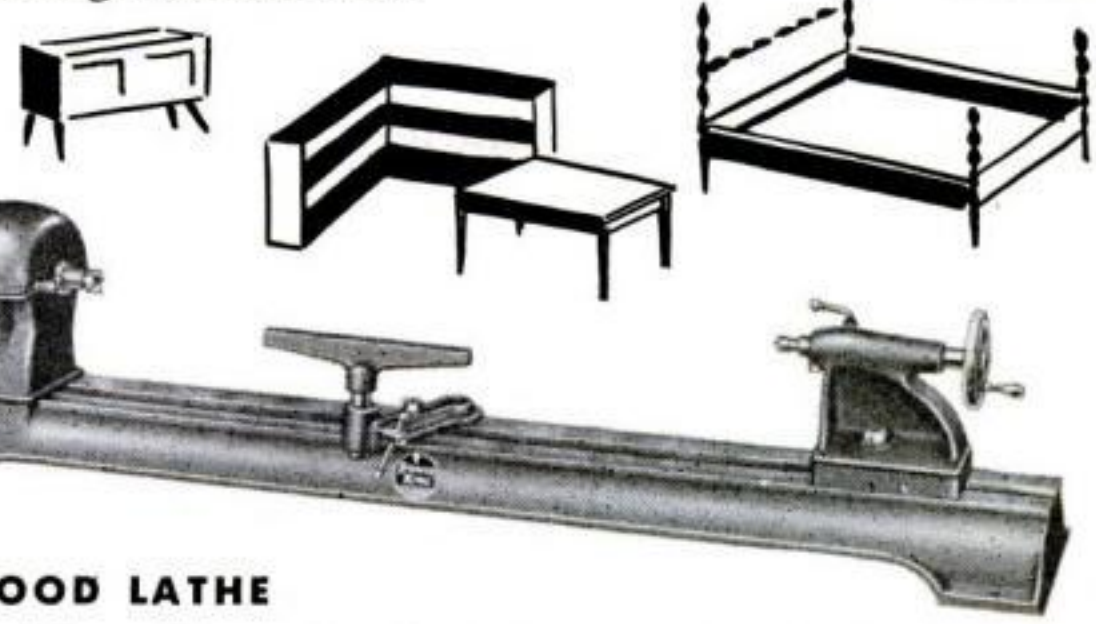




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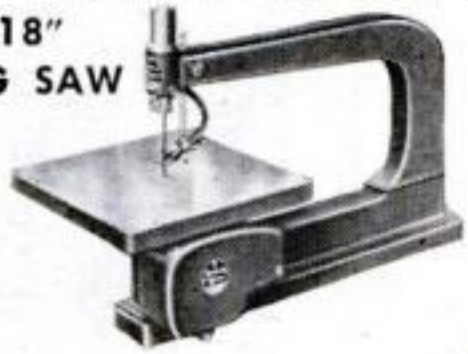
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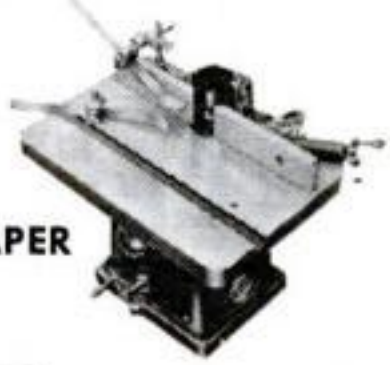
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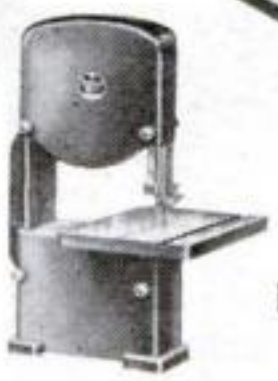
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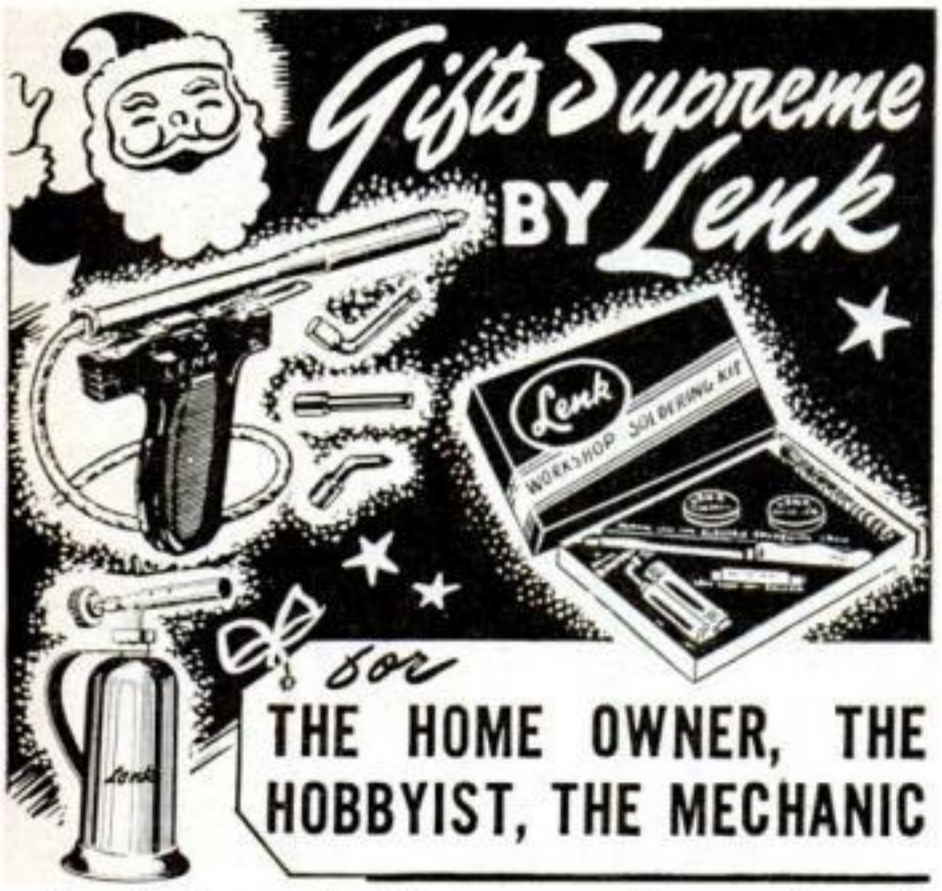
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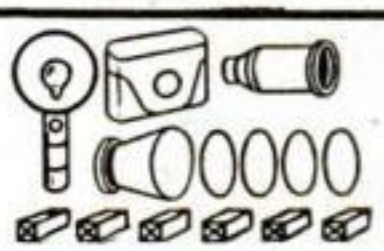
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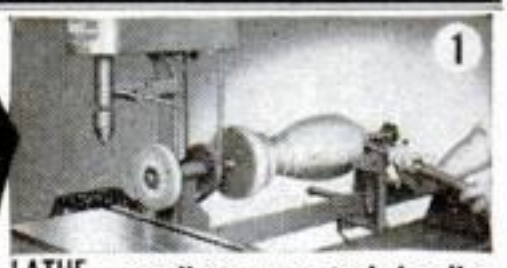
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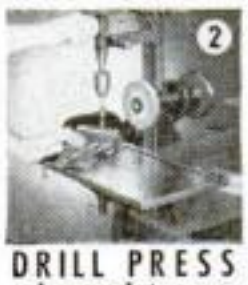
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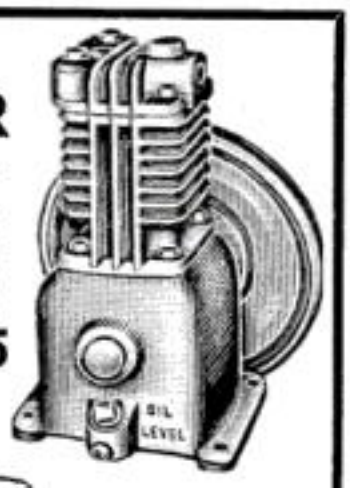
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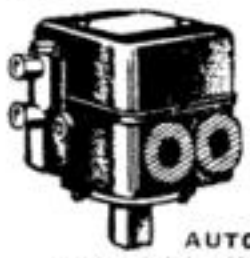




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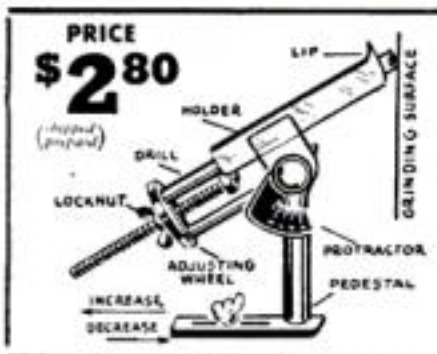
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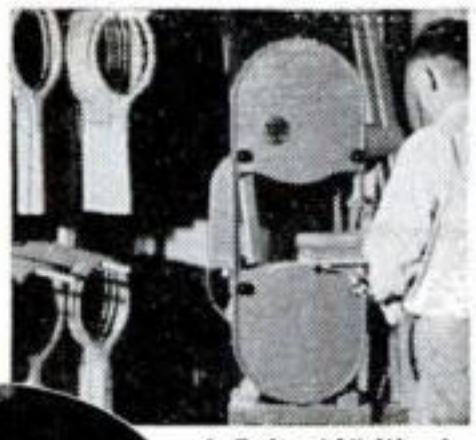
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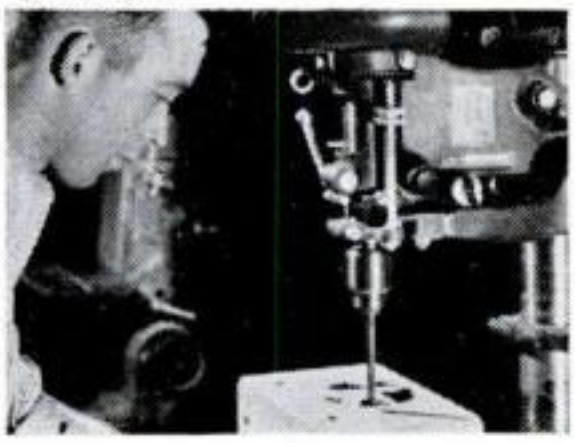
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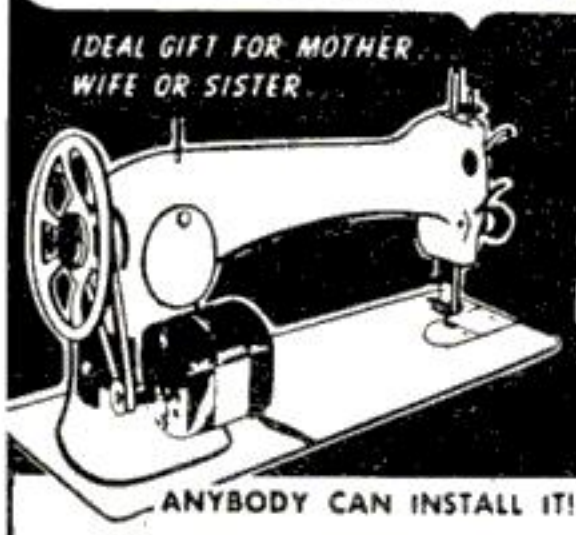
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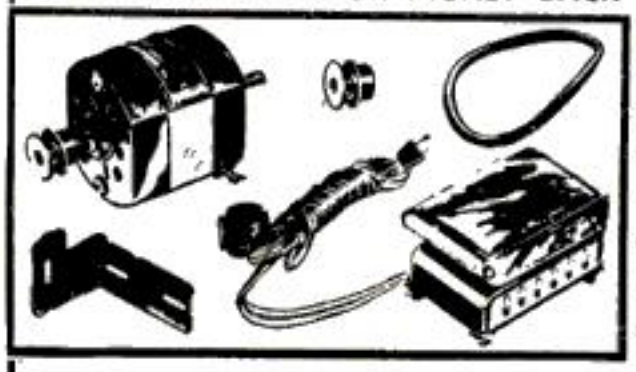
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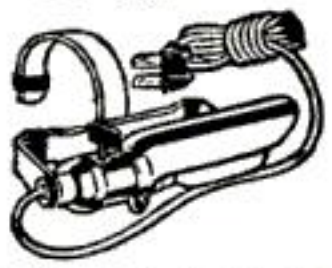


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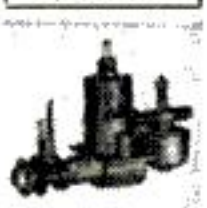
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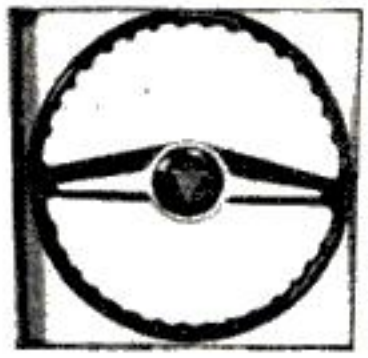
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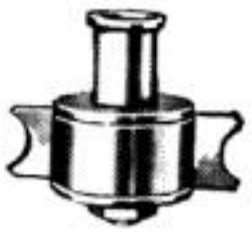
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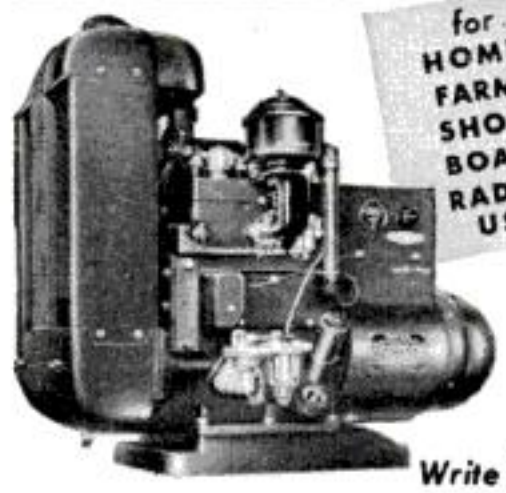
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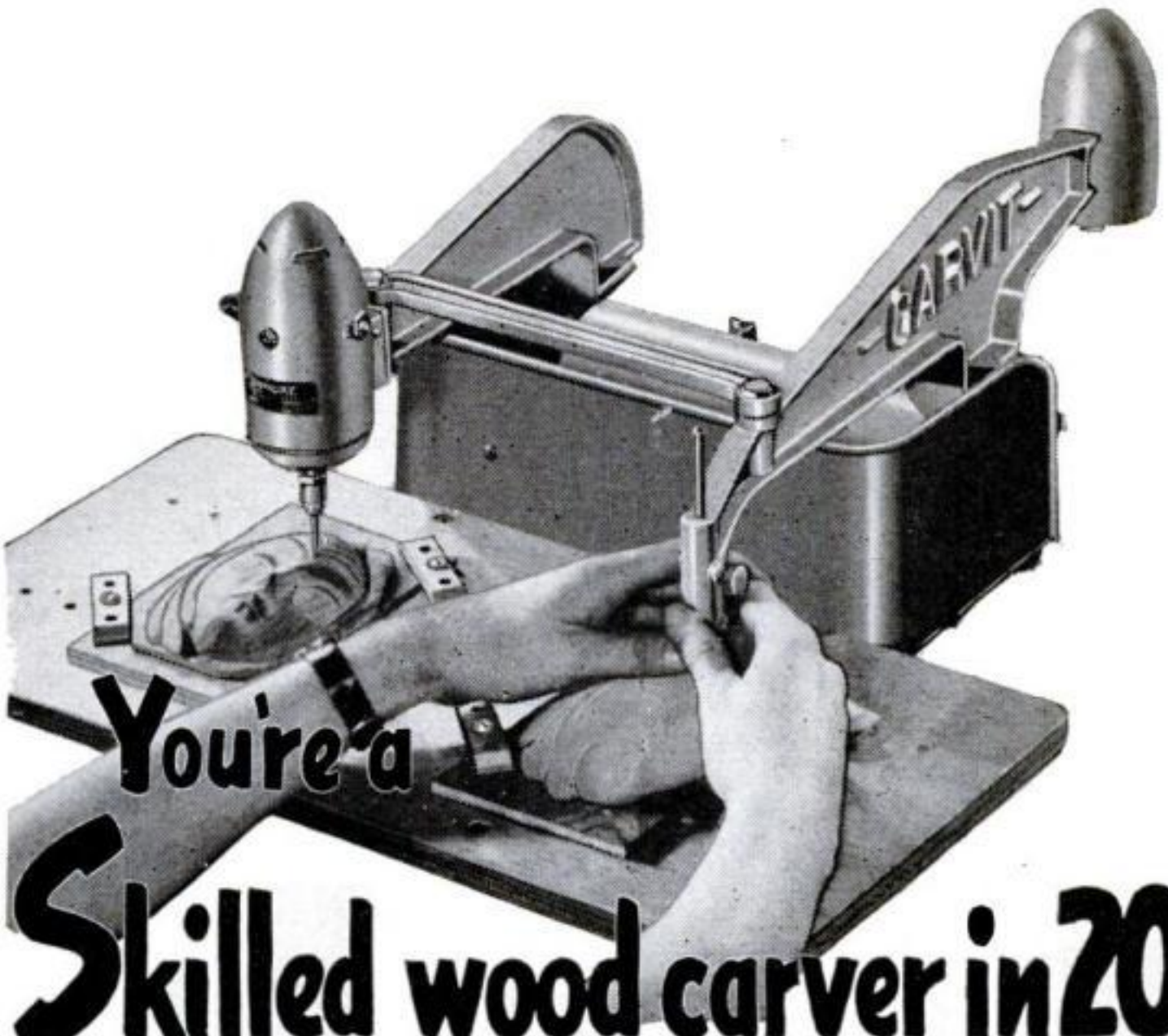


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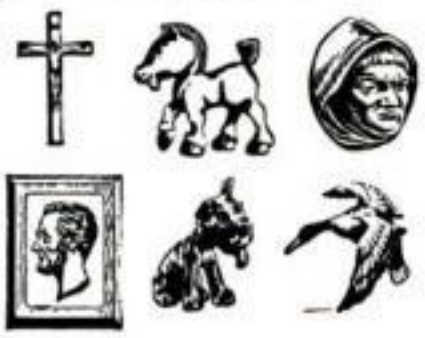
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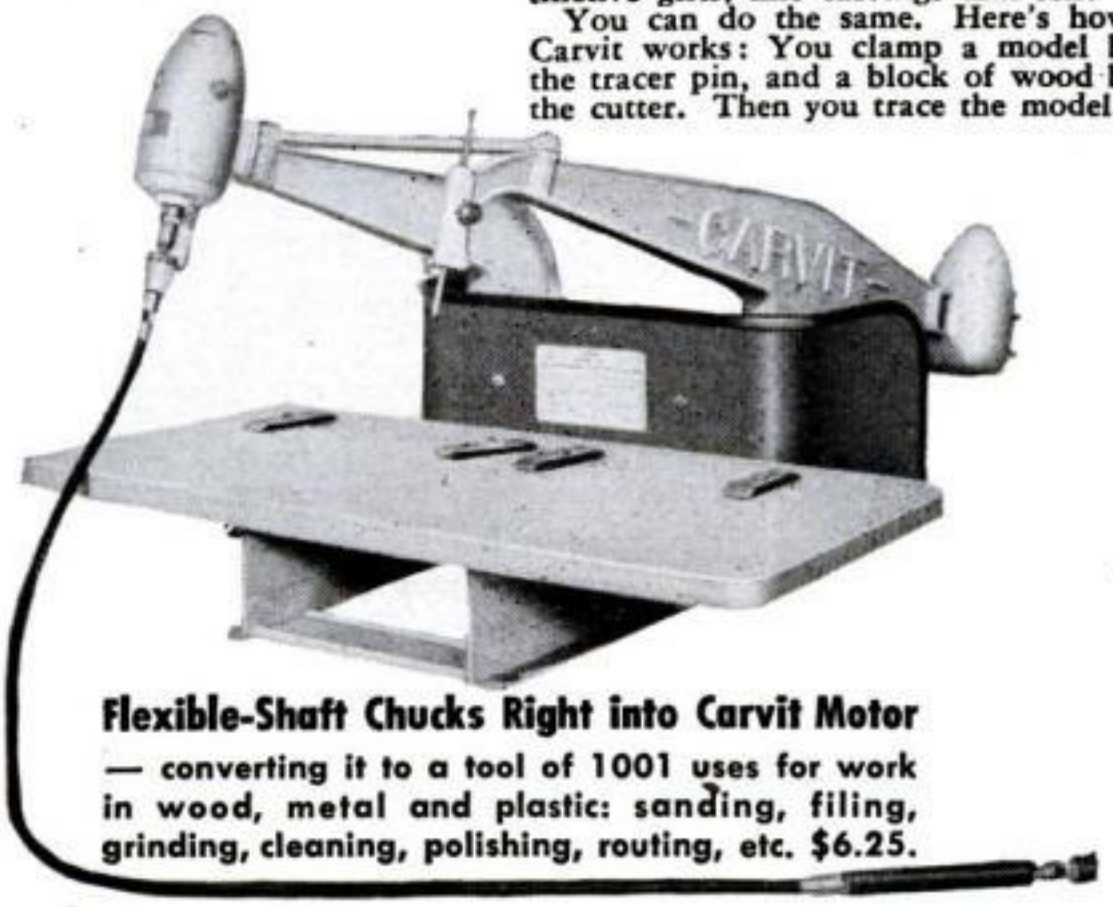
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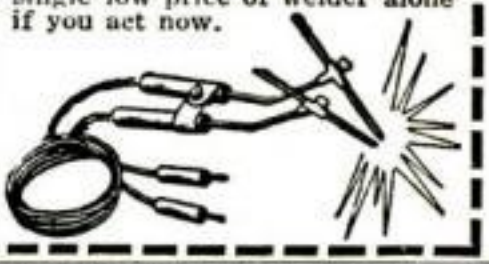
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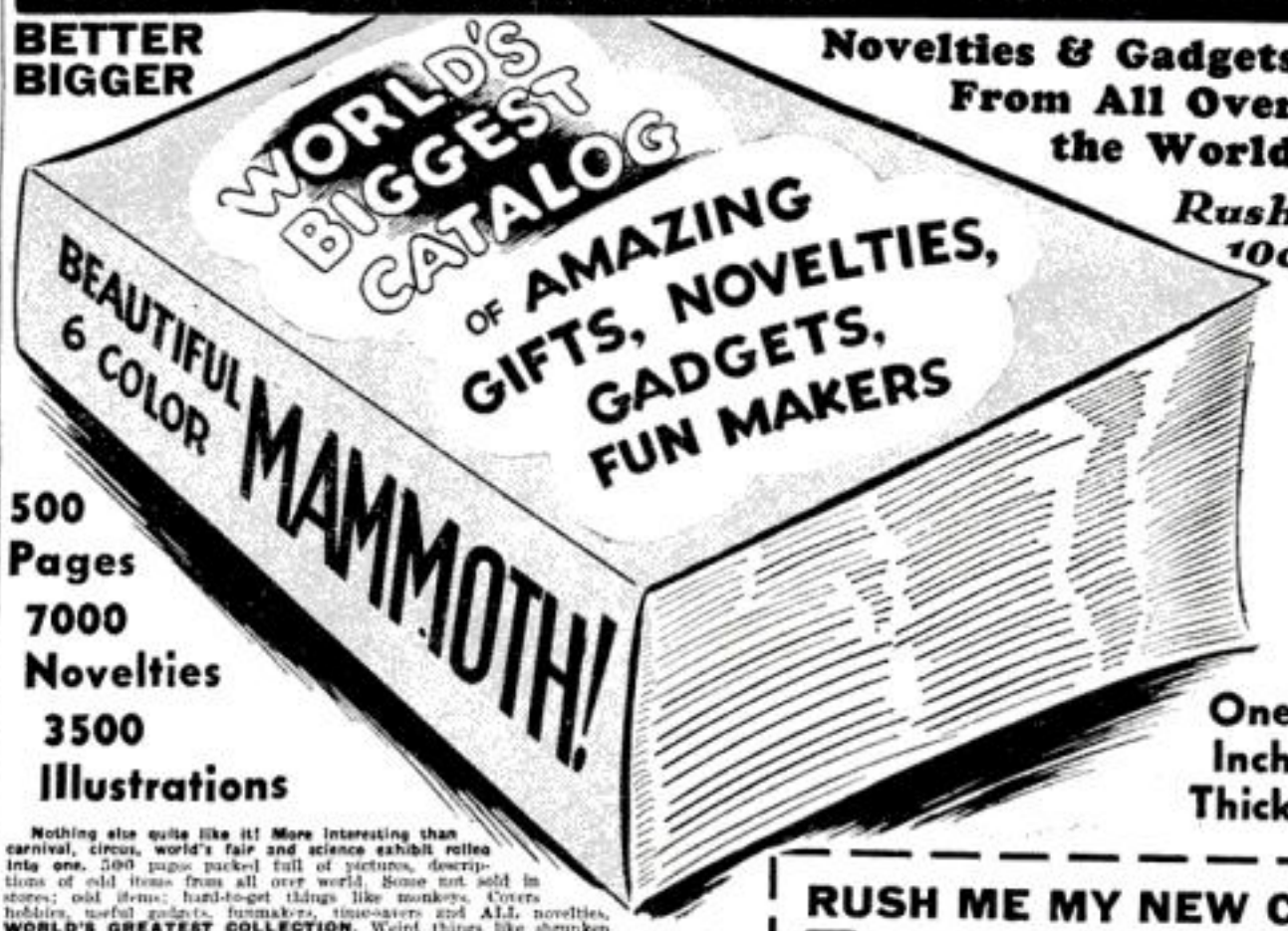
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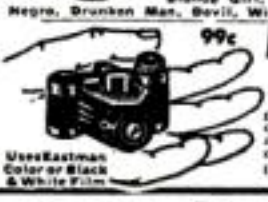
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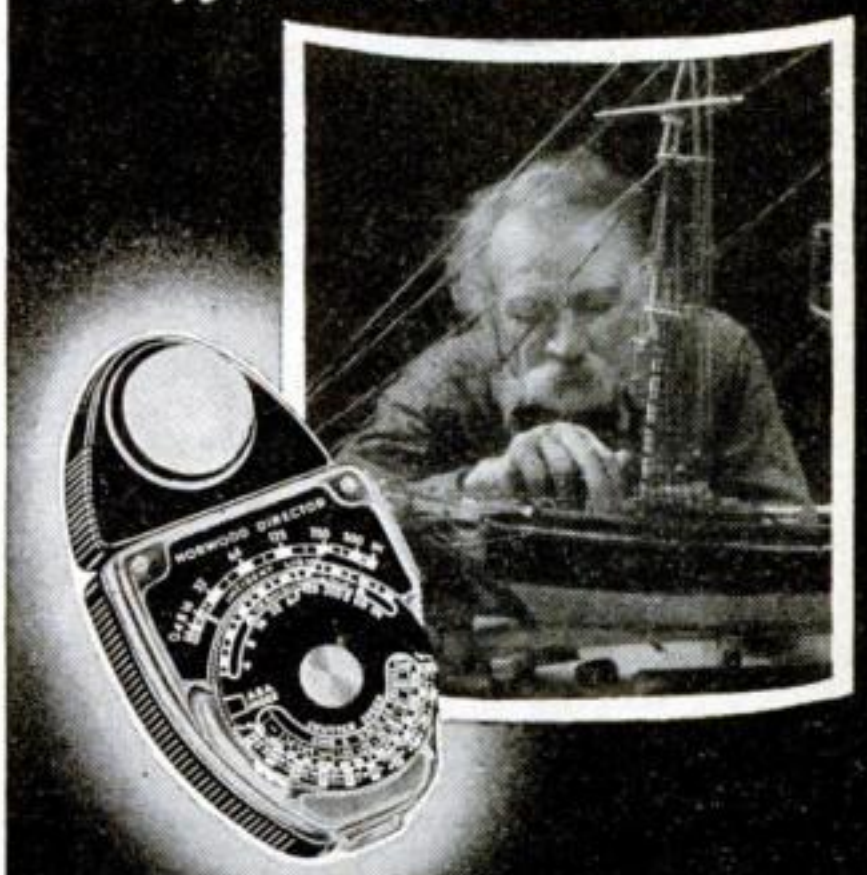
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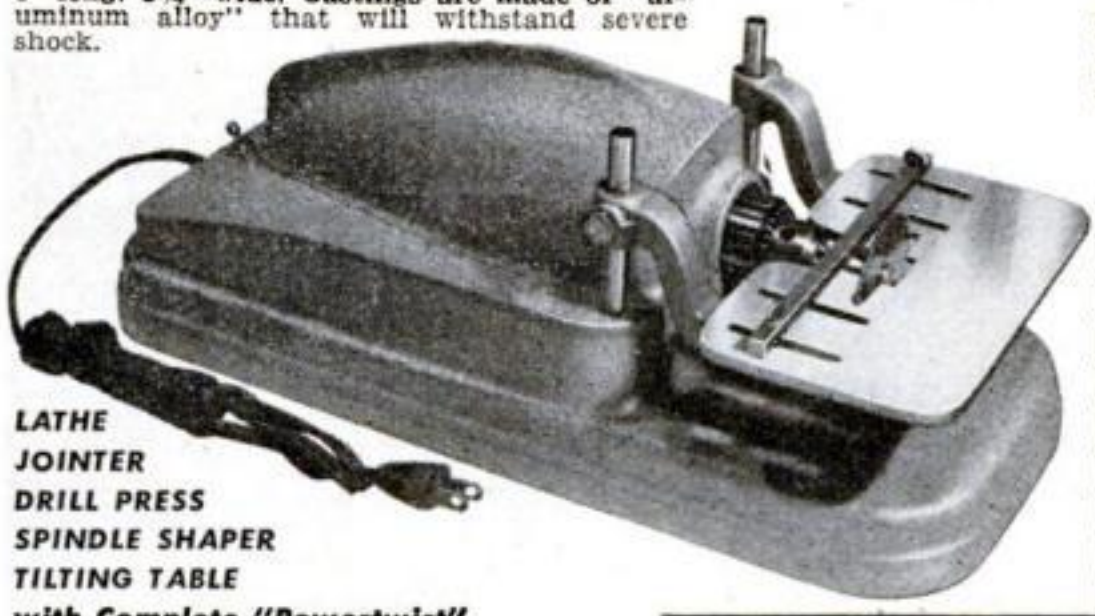
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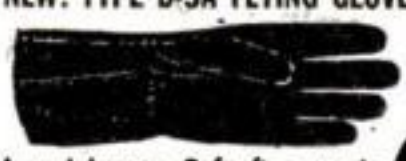


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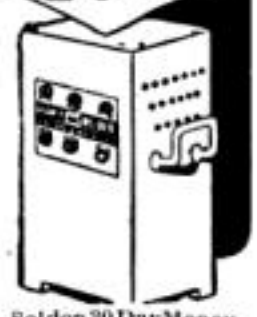
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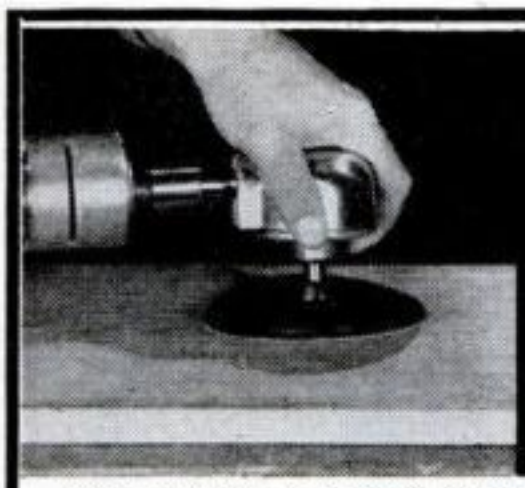
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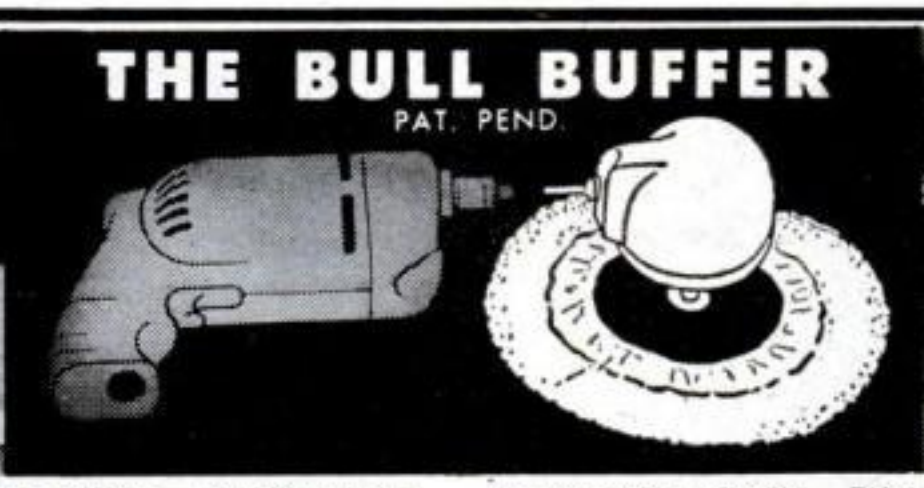
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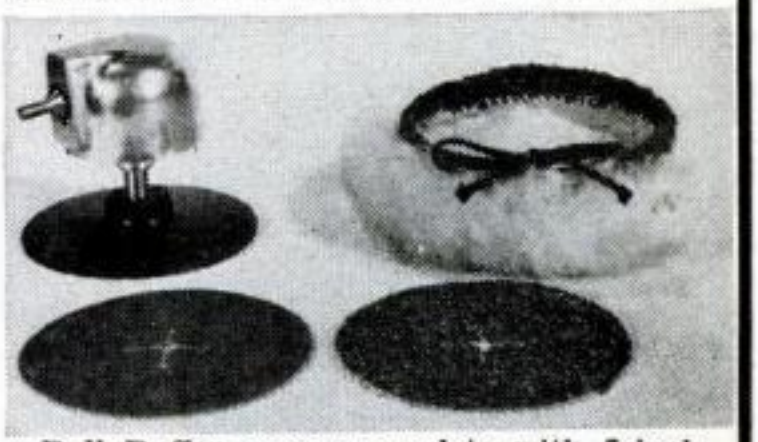


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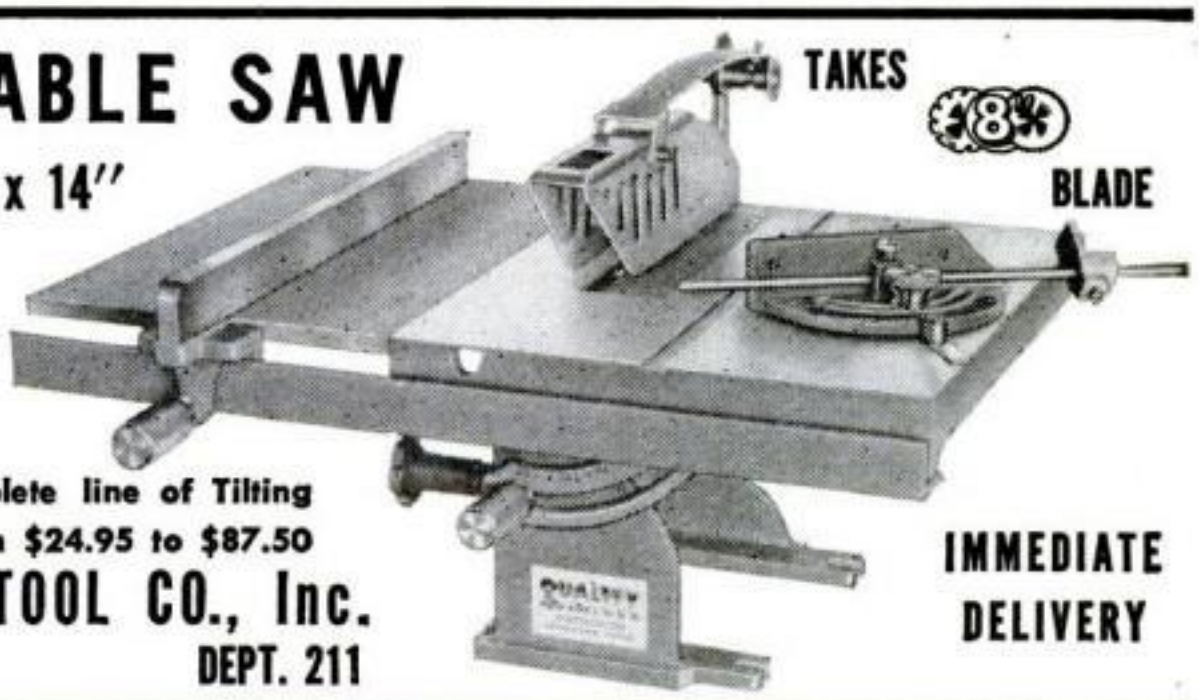
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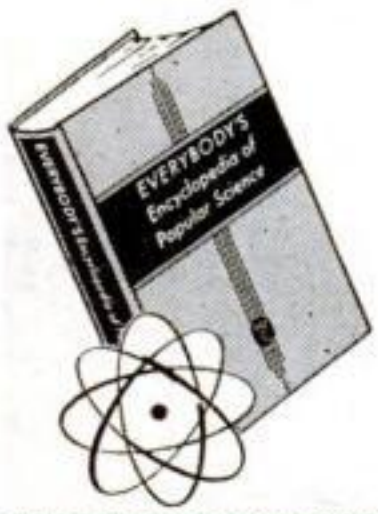
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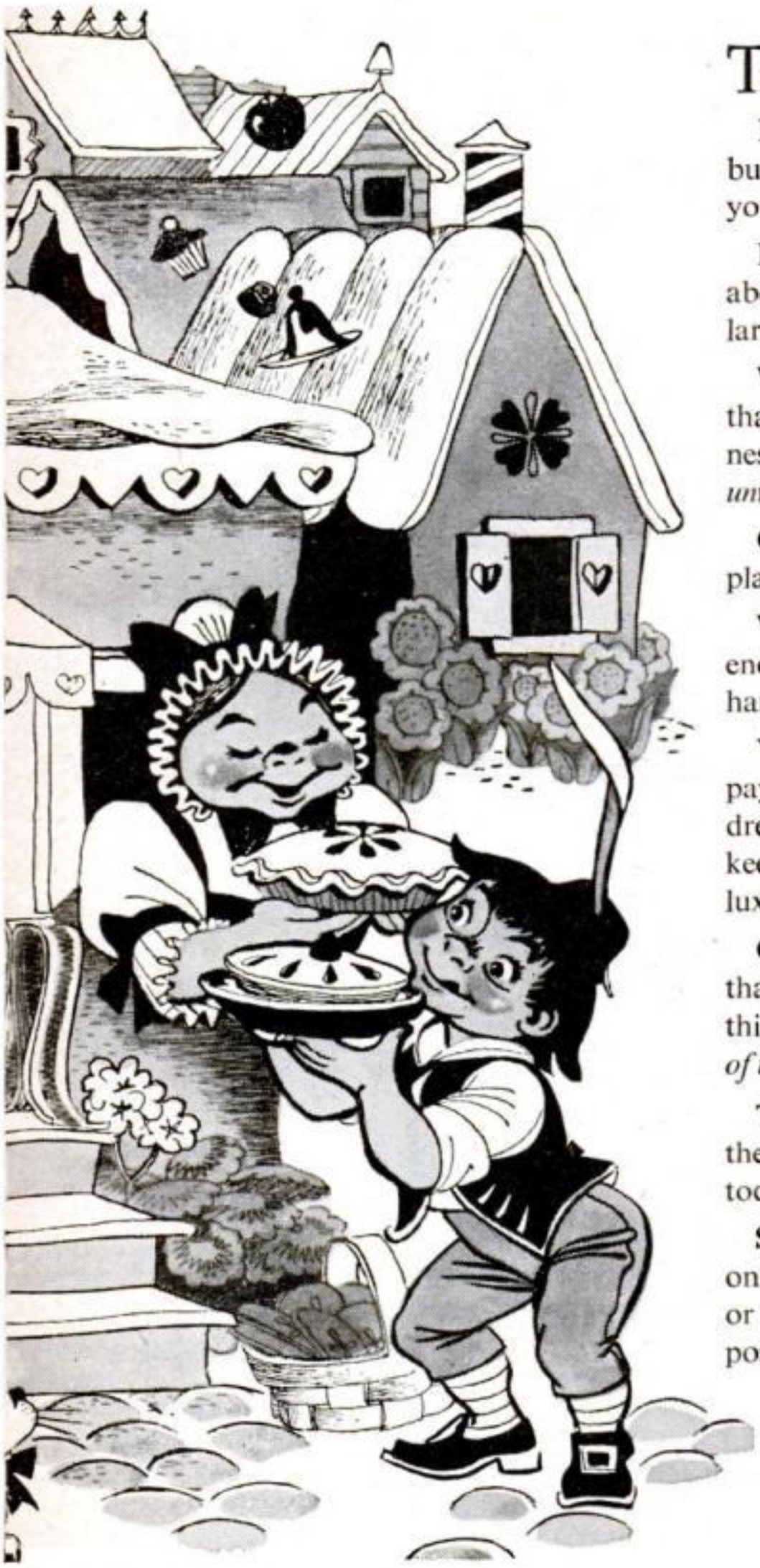
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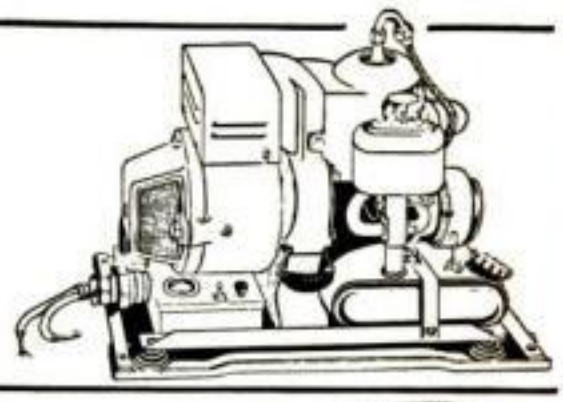


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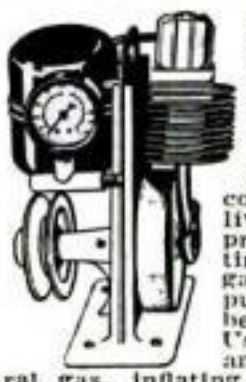
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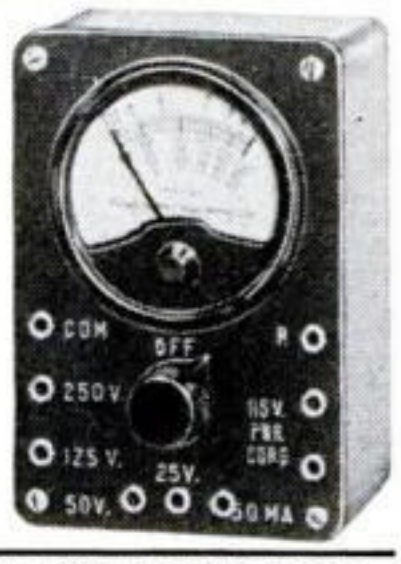
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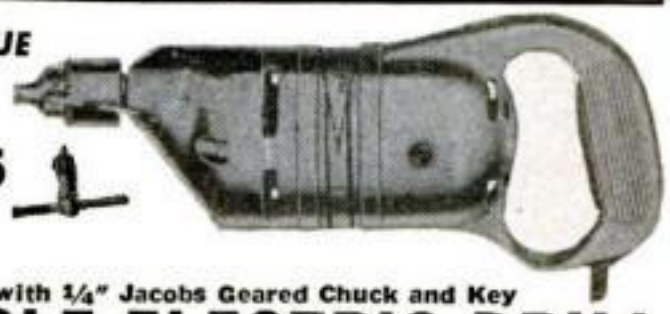
RT-1248 INTERCOMMUNICATION TRANSCEIVER

This brand new 15 tube transmitter-receiver was designed for mobile service on 12 volts, and will operate in the "Citizens' Band," where no govt. license to transmit is necessary. It's a cinch for any experimenter to connect this unit for 110 VAC operation by following the instructions and diagrams supplied, which cover numerous applications, including television. For those intending to use on car or boat, a new dynamotor, exactly as originally supplied, costs only $15.00. Don't fail to write for **FREE** descriptive bulletin. RT 1248 transceivers only **$29.95 each**, or **two for $53.90.**

RT-1655—11 tube crystal controlled superheterodyne receiver that covers the FM band. The ultra modern circuit uses the latest types of tubes including 7 miniature 6AJ5's. Beautiful chassis and aluminum cabinet. Tubes and schematic supplied.—**$14.95.**

TERRIFIC VALUE

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Equipped with ¼" Jacobs Geared Chuck and Key

PORTABLE ELECTRIC DRILL

(Sold at less than established factory price so we cannot mention brand name)

Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch, natural grip handle, and balance like a six shooter. Precision cut gears—turbine type cooling blower—extra long brushes. No stalling under heaviest pressure because of powerful 110 Volt AC or DC motor and multiple ball bearing thrust. Other bearings self-aligning lifetime-lubricated Oilite type. Made for toughest year-in and year-out service in plant or on construction jobs. Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use.

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RADAGER*

***Combination Auto Radio-Battery Charger**

Nationally advertised brand 1949 car radio that will fit practically any car. These car radios have plenty of eye appeal plus a host of other features that no other radio regardless of cost can offer.

Built in battery charger that will charge a car battery. The unique circuit of this radio steps up the 6 v input to 110v, that is available in a convenient outlet, for operation of an electric shaver or similar electrical appliance.

The radio is a powerful 6 tube superheterodyne that has a three gang condenser and a stage of radio frequency amplification for increased sensitivity. The radio, complete with built in battery charger and power outlet, is a single compact unit that is easily installed. **Sample—$39.95; Dealer price, $37.47** each in lots of two or more.

BUFFALO RADIO SUPPLY PS
219-221 Genesee Street
Buffalo 3, New York

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Cracked or peeling paint, varnish, enamel, shellac, or lacquer must be removed before the surface can be refinished properly. Wonder-Paste Remover makes this job easy. Simply apply Wonder-Paste with a paint brush directly over the old finish. **It will not run!** When penetration is complete, the old finish is reduced to a soft sludge that slides off like wet snow.

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FOR ALL OUTSIDE WINDOW WORK . . . UPSTAIRS OR DOWN

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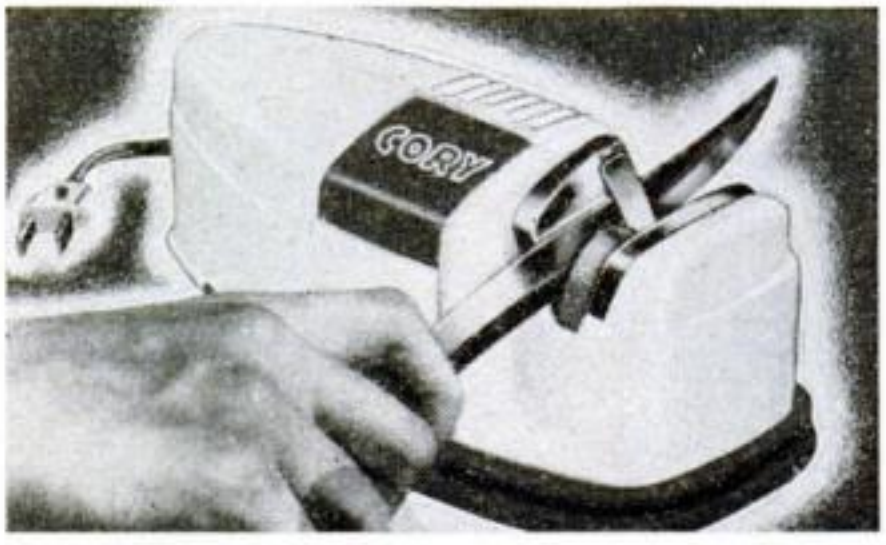
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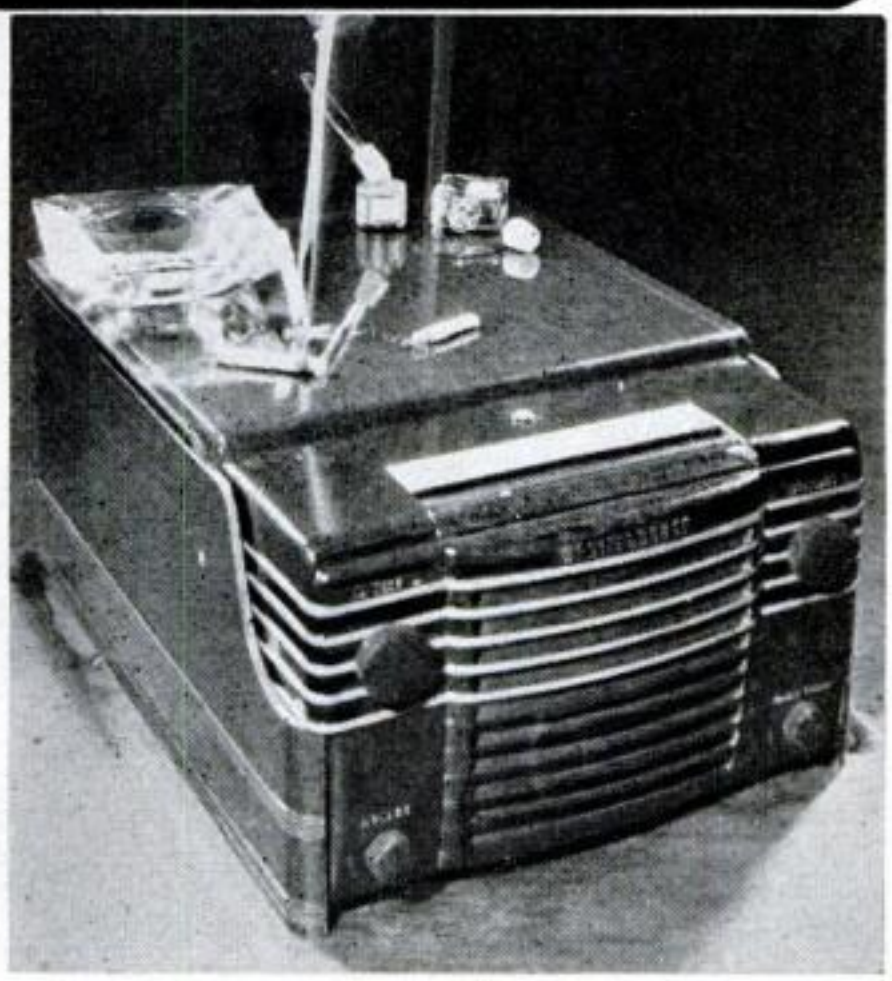
Electric Washers Fit Tubs. Two portable laundry-tub washing machines now are available. Tub-O-Wash ™, above, clamps on a tub. Made by Victor Electric Products, Inc., Cincinnati, Ohio, it's priced about $45. Metro Washer ™, which sits in the tub, is made by Metropole Machine Corp., Long Island City, N. Y. About $60.



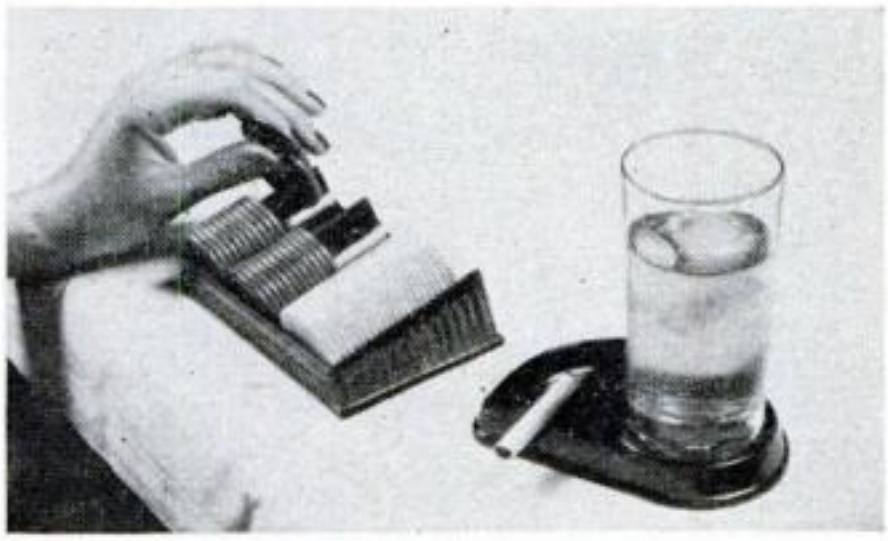
Motor Drives Home Sharpener. In this kitchen aid, a 115-volt AC motor spins an abrasive wheel at 3500 r.p.m. You draw knives through clips that hold them at the correct angle for sharpening. Weighing 3¾ lb., the device measures 3½" by 3½" by 8½", sells for about $12, and is made by the Cory Corp., Chicago.

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Modern Living



Nonmarring Radio Cabinet. Cigarettes burn out on this cabinet without leaving a mark, while finish-scarring liquids such as alcohol, salt water, or citric acid do not harm it. The manufacturer adds that the cabinet will not warp, splinter, or crack. The mahogany-like synthetic is Micarta ®, a Westinghouse phenolic laminate recently applied to radios by the company's Home Radio Division.



Rack Holds Chips. These playing-chip racks keep the card table orderly and are complemented by matching combination coaster-ash trays that hold a drink and a cigarette. The Sutone Company, of Hollywood, Calif., makes both pieces in a brown or black plastic that is burnproof and unaffected by hot water.

44 new ideas for your bathroom!



Here's the grand new *illustrated* booklet that shows you *how* to plan the perfect bathroom for your new home . . . or how to lend new charm and utility to your present bathroom!



Its smart *new* ideas are based on more than 25 years of leading the way with modern improvements in bathroom cabinet design, convenience and construction! Mirrors, crystal glass shelves, towel racks, accessories . . . see how to arrange them perfectly!





Let your bathroom reflect your own individuality and good taste. This booklet is full of wonderful suggestions!



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Make your car sparkle, easily and quickly, by using our light weight washer—45" long. No fuss or getting wet. Great for women. W S Minneapolis writes "I paid twice your cost for one, but it's too clumsy I much prefer yours, it's really so easy."

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We Guarantee Satisfaction. *No C.O.D.'s please.*

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ENGINE: Double acting, oscillating type—Cast Brass and Aluminum—Stainless steel connecting rod and drive shaft. Two-step pulley for speed change. Develops 1/30-H.P. at 1000 R.P.M. Made to engineering standards.

BOILER: 18-gauge. Seamless Drawn Brass. Whistle safety valve, throttle, water gauge. 475-watt heating element generates sufficient power to do REAL job operating models, toys, gadgets. Engine and Boiler mounted on heavy metal base. Size: 6" x 9" x 11" high, 7 pound weight. GUARANTEED SAFE.

SEND NO MONEY. Write your order on a post card; we ship C.O.D. (you pay postage and small C.O.D. charge). SEND $13.50 check or money order, sent Post Paid.

DO IT NOW . . . *THEY WON'T LAST LONG!*

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Attach TRIMIT to a ¼" electric drill and you have a power-driven clipper that whizzes through hedges, weeds, etc. Perfect for edging flower beds, walks. Simple, one screw assembly. Costs only $9.95. Combination set of TRIMIT and ¼" B. & D. drill only $27.95. Send check, money order, or C.O.D. order. Card enclosed if sent as gift.

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Sets hand saw teeth in 60 seconds—Approx. 400 band saw teeth. 4½ to 12 points with one adjustment. Hammer and anvil action does precision job. Every tooth alike—no breakage.

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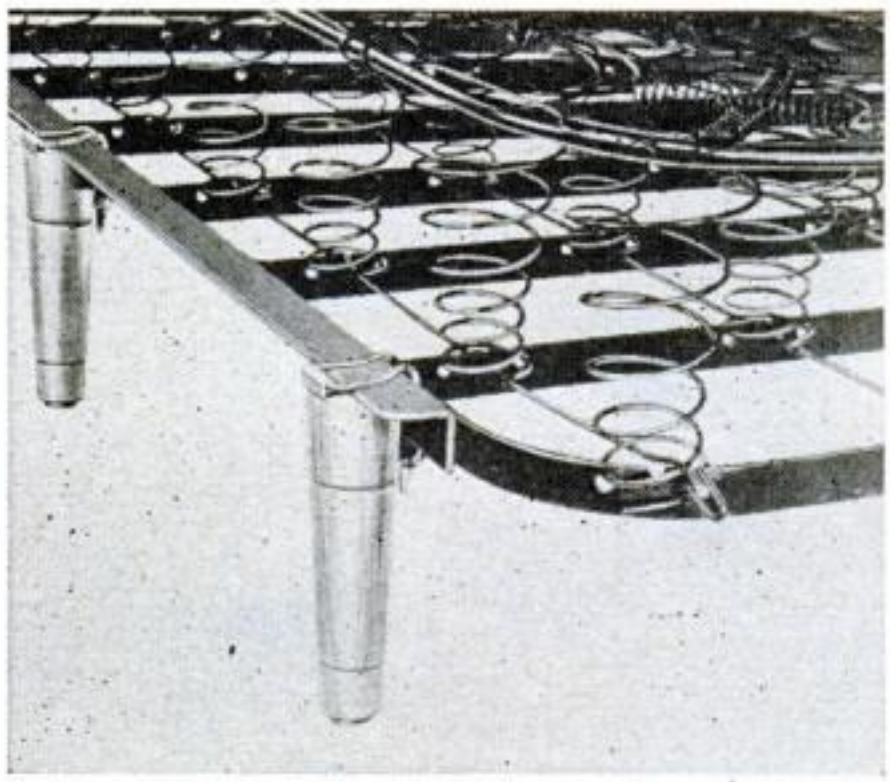
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BEAVER MFG. CO.

Aids to Modern Living

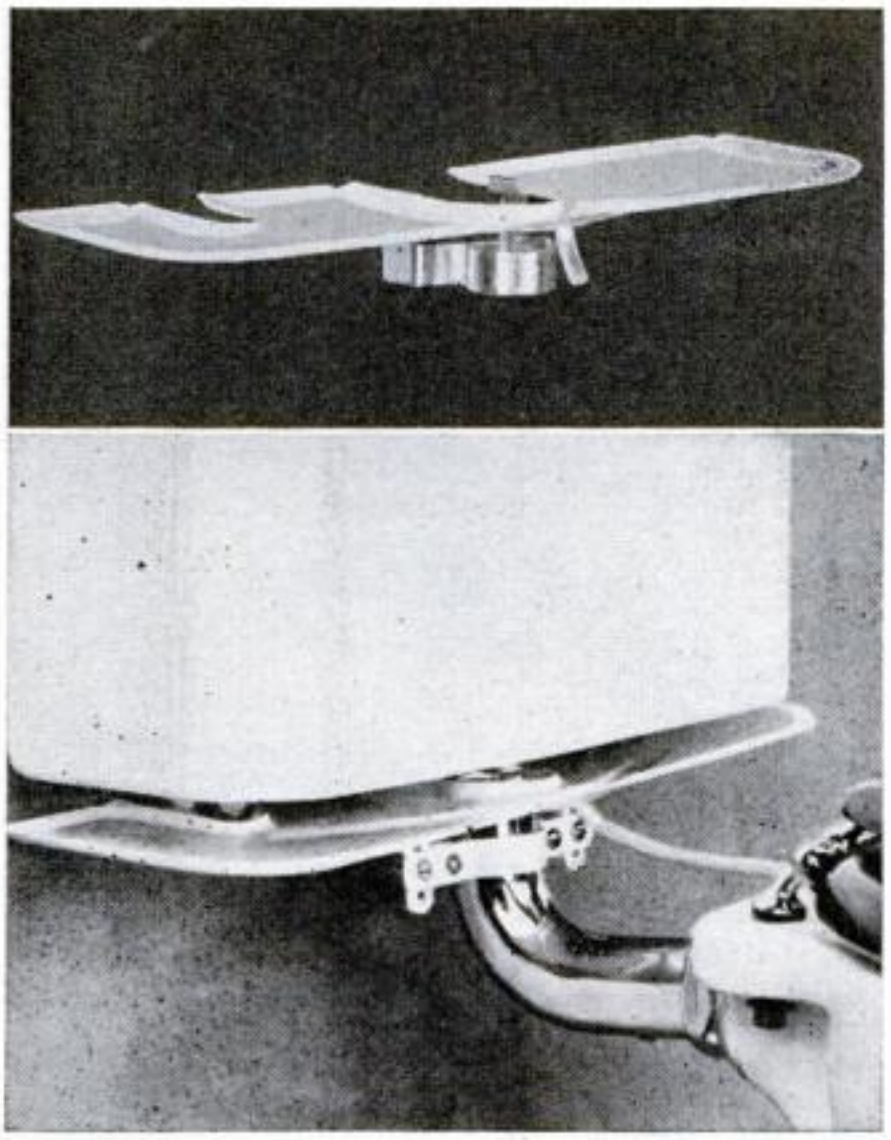


Plastic Screens Baby Carriage. Designed for comfort in either hot or cold weather, this baby coach by Thayer, Inc., New York, N. Y., has plastic side screens that may be covered with snap flaps. The flexible mesh does not rust, corrode, or fade and may be cleaned with a damp cloth Price is about $45.

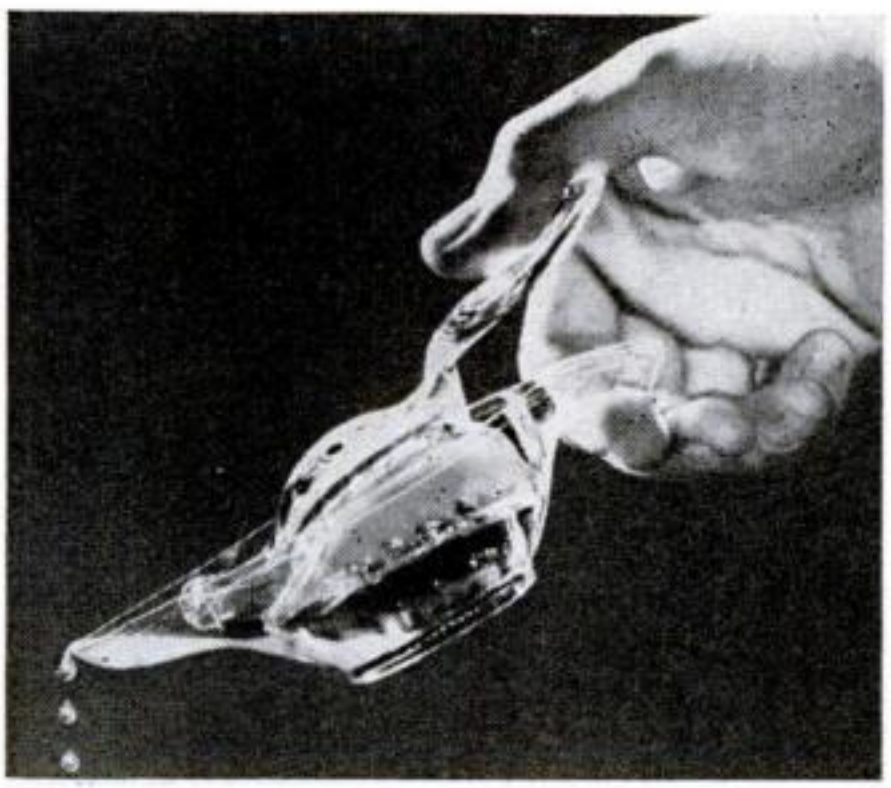


Bed Legs Snap On. Coil springs become a bed in a jiffy when six hardwood legs are snapped to the iron frame. Made by Colson Bros., of Los Angeles, the legs stand 7" high and are held in place by heavy wire clips. The two center legs stand on nonskid rubber feet; the others rest on metal gliders. Price: $5.95.

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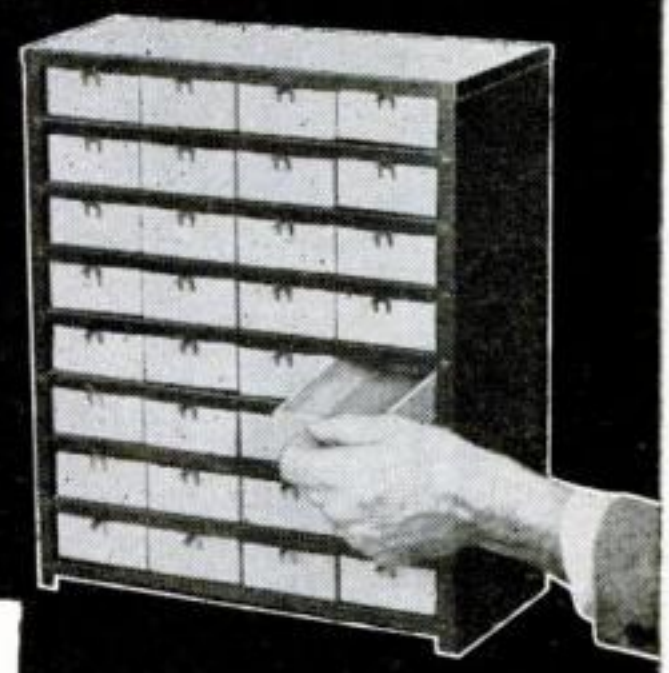
Tray Catches Stray Drips. Damage or discoloration of bathroom floors is avoided with the aluminum Drip Not ® tray that clamps under a toilet tank. The moisture that condenses on the cold tank surface is piped directly into the bowl through a small hose. Laufenberg, Inc., of Milwaukee, Wis., is the maker.



Squeezes and Pours Juice. Made of clear plastic, this little combination juicer, strainer, and server gives you just the amount of lemon juice you want. As the top and bottom handles are brought together, a lemon quarter is squeezed and strained. The gadget is offered by Crystalier Co., of New York, N. Y., at $1.25.

NOW

THE JIFFY METAL CABINET
WITH RUSTPROOF ALUMINUM DRAWERS



32 DRAWER UNIT $8.95
POSTAGE PAID
64 DRAWER UNIT $15.95

APPROXIMATE SIZES DRAWER
1¼" Deep
2¾" Wide
6" Long

32 DRAWER UNIT
6" Deep
12¾" Wide
15¼" High

64 DRAWER UNIT
6" Deep
25½" Wide
15¼" High

for home or shop, the handy way to keep small parts, washers, nuts, bolts, nails, screws, etc.

AND STILL AVAILABLE

32 DRAWER UNIT $5.95
POSTAGE PAID
64 DRAWER UNIT $9.95

Solid one-piece aluminum drawers for greater strength and long life—and still at low cost. So handy to keep office, shop, work bench, household and hobbyist needs at your fingertips. Spot welded steel cabinet, enamel finish, and metal flange drawer guides.
32-Drawer Unit — $8.95. 64-Drawer Unit—$15.95. Postage Paid. Send check or money order. No C. O. D.'s, please. Add 3% sales tax for Ohio orders.

THE JIFFY METAL CABINET
WITH LAMINATED FIBREBOARD DRAWERS

Same steel cabinet as above with covered fibreboard drawers. Suitable for most home needs. Thousands in use. 32-Drawer unit —$5.95. 64-Drawer unit—$9.95. Postage Paid. Check or money order. No C.O.D.'s. Add 3% sales tax for Ohio orders.

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TO: Reader
FROM: Editor

Hard Job Well Done



Herbert Yahraes

WRITING about science looks easy when it's done well. A lot of scientists, teachers, newspapermen, and enthusiastic amateurs try it every day. Most of them find that it is much harder work than they had thought. Very few do it well.

That's why the same person's by-line is likely to appear not once but many times in POPULAR SCIENCE. When we find a fellow who really makes the concepts, difficulties, and achievements of scientists easy for you to understand, we encourage him to keep on producing such articles for you.

One of those fellows is Herbert Yahraes, whose name you may also have noticed in *The Saturday Evening Post, The Woman's Home Companion, Liberty, The American Mercury,* or some other magazine. He is a 43-year-old former newspaperman who lives in a cavernous old house four miles from the Stanfordville, N. Y., grocery store.

Yahraes served a long apprenticeship on The Associated Press, *The New Orleans Item and Tribune,* and several other newspapers before becoming a full-time magazine writer. He has written so much about medical matters for so many magazines in the last few years that he frequently receives mail addressed to "Dr. Yahraes." But he doesn't enjoy writing about medicine. "Every time I tackle a disease," he explains, "I get the symptoms. After writing a pamphlet on alcoholism, I couldn't even touch beer for three months."

Such reactions made life so dismal for Herb that he welcomed our suggestion a couple of years ago that he try doing some stories for POPULAR SCIENCE. The first one was about liquid helium. It was an extremely difficult assignment. He had to go back and interview a Yale physicist three times before he finished the article. But he felt so good afterwards that we succeeded in talking him into writing several more articles for us.

One of them, called "Static from the Stars," appeared last January. It was the only article given honorable mention in the competition this year for the $1,000 prize awarded by the Westinghouse Educational Foundation to the writer of the best science article in a magazine. And, says Yahraes, "of all my writing as a free lance, that was the story I enjoyed doing most."

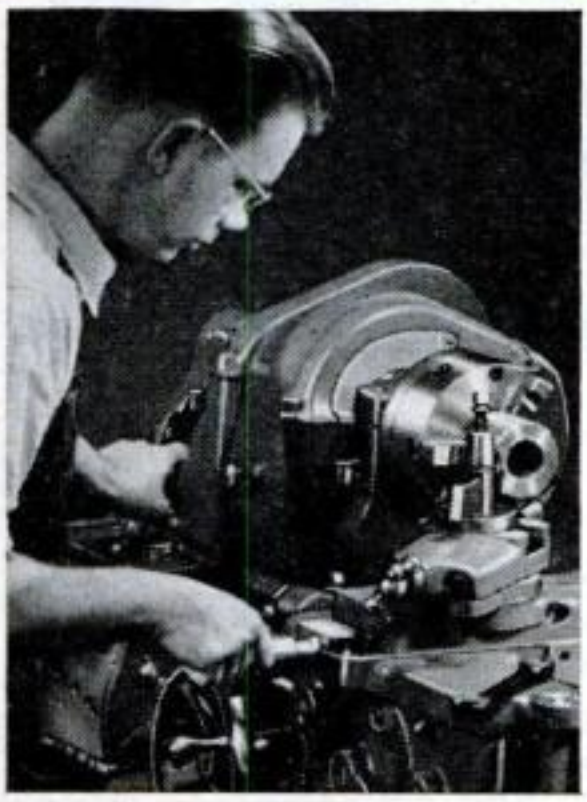
The winner of the Westinghouse prize was Dr. Florence Moog, an assistant professor at Washington University in St. Louis. She wrote about "The Biology of Old Age" for the *Scientific American.* It was such an interesting article that we wished, when we read it, that we had had it in POPULAR SCIENCE.

Another $1,000 prize was given by the Westinghouse foundation to the writer of the best science story in a newspaper—and that was won by Frank Carey of The Associated Press. We were pretty happy about this because Carey also has done some writing for us. He was the author of the piece called "Don't Try to Crash This Gate" about security precautions at the Atomic Energy Commission's headquarters, which appeared in POPULAR SCIENCE last February.

Volta Torrey

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SOUTH BEND *Precision* MACHINE TOOLS



NEW 13" & 14½"—1" COLLET LATHES

The 13" and 14½" swing South Bend Lathes are now available with larger headstock spindles having 1⅜" bore, which permits using the No. 5 South Bend Collet which has 1" maximum capacity. Except for the increased capacity through the spindle and collet, these lathes are the same as the regular 13" and 14½" lathes shown on the following pages.

Prices include 3 ph. motor and control.

Lgth. of Bed Feet	13"—1" Collet Lathes				14½"—1" Collet Lathes			
	Quick Change		Toolroom		Quick Change		Toolroom	
	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price
4	145-A	$1294.25	.....	.....	.....	.....	.....	.....
5	145-B	1332.25	8145-B	$1694.25	185-B	$1581.25	8185-B	$1963.25
6	145-C	1370.25	8145-C	1734.25	185-C	1621.25	8185-C	2008.25
7	145-D	1408.25	8145-D	1774.25	185-D	1661.25	8185-D	2053.25
8	.....	.....	.....	.....	185-E	1701.25	8185-E	2098.25

NEW 14 INCH DRILL PRESS

A ruggedly built tool unsurpassed for accuracy, ease of operation and dependable performance. Features free-floating spindle, precision ball bearings, quick-acting belt tension release, etc. Has built-in light for illumination of work. Drill capacity is ½" in steel. Prices include ⅓ h.p. single ph., 60 cycle, 115 V. motor and switch.

Bench Model..$129.30
Floor Model... 144.30



NEW 7" BENCH SHAPER

The South Bend 7" Precision Bench Shaper has been developed to meet toolroom and industrial demands for an accurate, compact bench shaper that is precision engineered and sturdily constructed.

Ram has 0" to 7" stroke. Tool head has 3" feed and swivel clapper box. Table is 5 7/16" x 5" x 6" deep, has 13" horizontal travel, 5" vertical travel. Has power cross feed. Vise opens to 4" and has graduated swivel base.

Prices Quoted on Request.



All prices in this catalog are net f.o.b. factory unless otherwise stated

SOUTH BEND LATHE WORKS

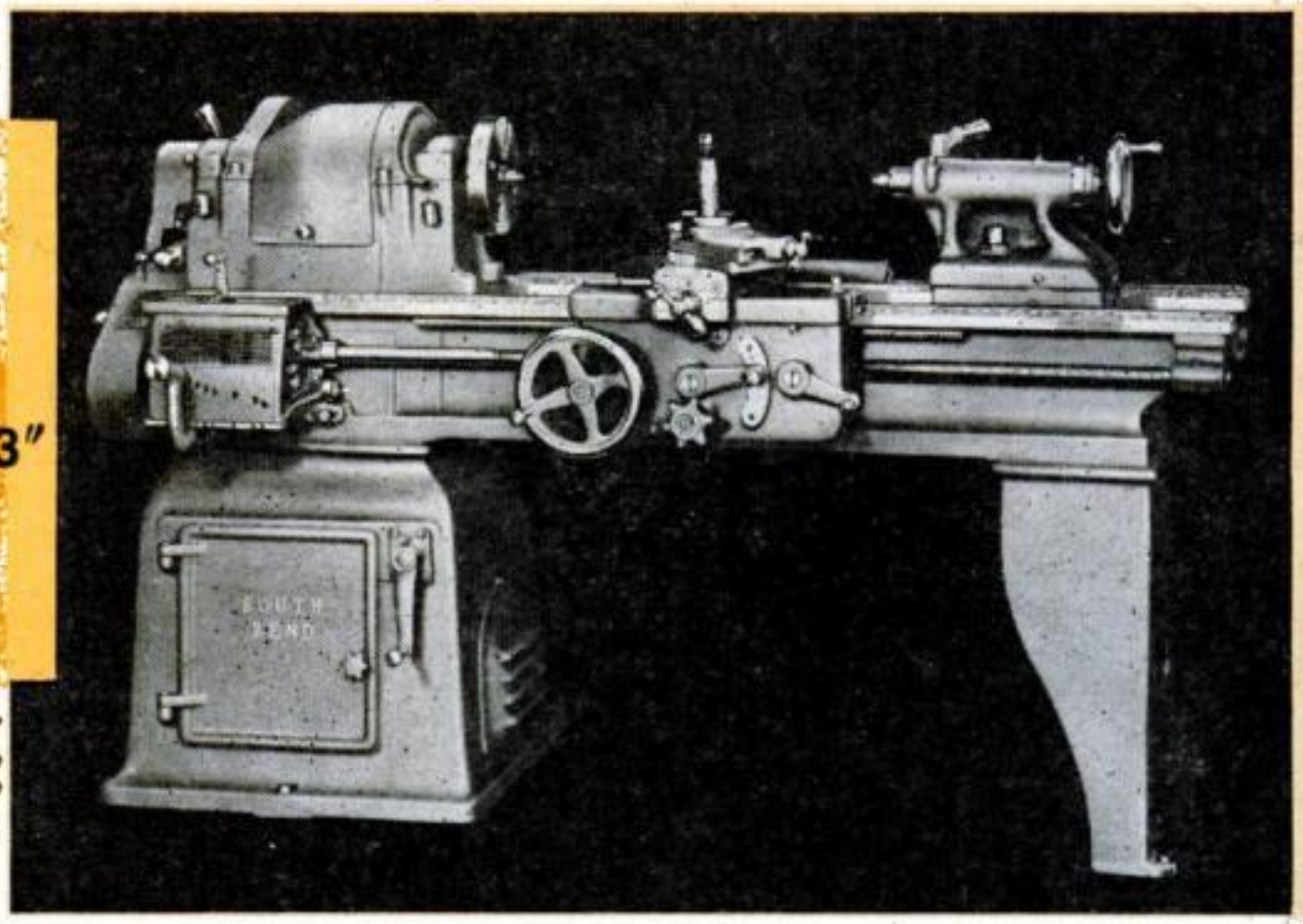
BUILDING BETTER TOOLS SINCE 1906

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SOUTH BEND

16", 14½", and 13" Quick Change Gear Lathes



South Bend 16" x 6' Quick Change Gear Lathe

$1729.25

SPECIFICATIONS	16-INCH	14½-INCH	13-INCH
Swing over bed and saddle wings	16¼"	14⅝"	13⅛"
Swing over saddle, chip guard removed	11⅛"	10¼"	8¾"
Swing over saddle with chip guard	9⅝"	8¾"	7¾"
Spindle speeds	26 to 885 r.p.m.	27 to 800 r.p.m.	34 to 875 r.p.m.
Thread cutting range	4 to 224 R.H. or L.H.	4 to 224 R.H. or L.H.	4 to 224 R.H. or L.H.
Power longitudinal feeds	.0015" to .0841"	.0015" to .0841"	.0015" to .0841"
Power cross-feeds	.0006" to .0312"	.0006" to .0312"	.0006" to .0312"
Hole thru spindle	1⅜"	1⅛"	1"
Collet capacity	1"	¾"	11/16"
Spindle centers	No. 3 Morse Taper	No. 3 Morse Taper	No. 3 Morse Taper
Size motor	1½ h.p.	1½ h.p.	1 h.p.

South Bend Quick Change Gear Lathes are equally efficient on precision toolroom work or close tolerance manufacturing operations. Hundreds of nationally known manufacturers select them when streamlining their shop equipment to meet present day needs. Substantial savings in capital investment, power consumption, floor space, and labor costs have resulted from their installation. They will give you the same efficient service.

The Underneath Motor Drive provides an unusually wide range of spindle speeds. The belt drive to the spindle is silent in operation and develops smooth, steady power entirely free from gear vibration.

Price includes 3 ph., 60 cy., 220 v. A.C. motor and drum control, and regular lathe equipment such as belts, centers, face plates, tool post, etc. Chucks and tools are extra. See following pages.

TIME PAYMENT TERMS

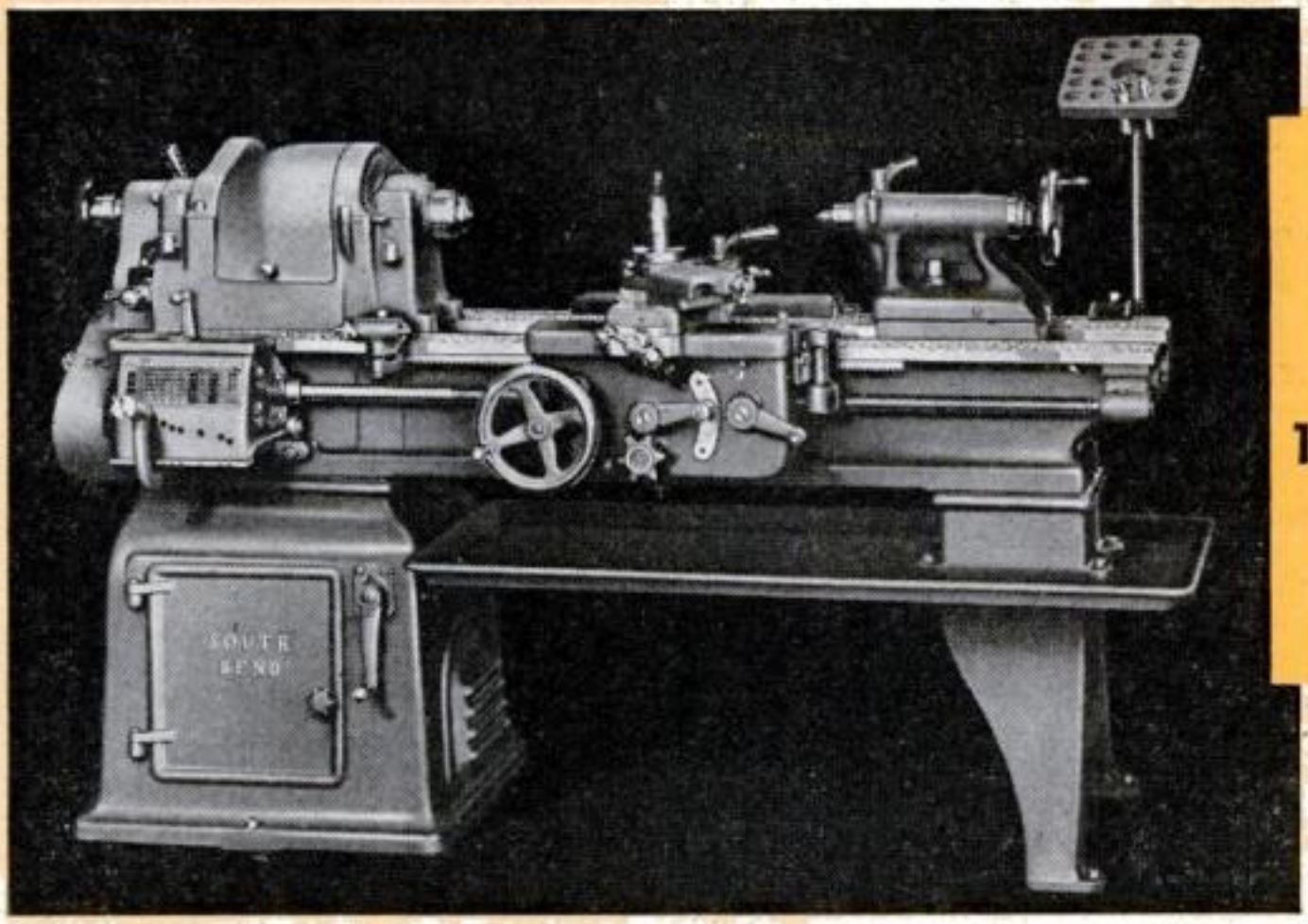
25% down, balance 12 mos., moderate finance charge (unless federal law requires otherwise)

Quick Change Gear Underneath Motor Driven Lathes

Catalog Number	Swing Over Bed Inches	Length of Bed Feet	Distance Between Centers Inches	Approx. Shipping Weight Pounds	Price f.o.b. Factory
16" QUICK CHANGE GEAR LATHES					
117-C	16¼	6	33½	2300	$1729.25
117-D	16¼	7	45½	2380	1769.25
117-E	16¼	8	57½	2460	1809.25
117-G	16¼	10	81½	2620	1924.25
117-H	16¼	12	105½	2850	2039.25
14½" QUICK CHANGE GEAR LATHES					
183-B	14⅝	5	24½	1995	$1466.25
183-C	14⅝	6	36½	2070	1506.25
183-D	14⅝	7	48½	2145	1546.25
183-E	14⅝	8	60½	2225	1586.25
13" QUICK CHANGE GEAR LATHES					
113-A	13⅛	4	16	1460	$1189.25
113-B	13⅛	5	28	1510	1227.25
113-C	13⅛	6	40	1560	1265.25
113-D	13⅛	7	52	1615	1303.25

SOUTH BEND LATHE WORKS, 524 E. Madison Street, South Bend 22, Indiana, U.S.A.

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SOUTH BEND

16", 14½", and 13" Toolroom Lathes

South Bend 16" x 6' Toolroom Lathe
$2145.25

SPECIFICATIONS	16-INCH	14½-INCH	13-INCH
Swing over bed and saddle wings...	16¼"	14⅝"	13⅛"
Swing over saddle cross slide.....	9⅝"	8-15/16"	8"
Spindle speeds.....	26 to 885 r.p.m.	27 to 800 r.p.m.	34 to 875 r.p.m.
Thread cutting range.....	4 to 224 R.H. or L.H.	4 to 224 R.H. or L.H.	4 to 224 R.H. or L.H.
Power longitudinal feeds.....	.0015" to .0841"	.0015" to .0841"	.0015" to .0841"
Power cross-feeds.....	.0006" to .0312"	.0006" to .0312"	.0006" to .0312"
Hole thru spindle.....	1⅜"	1⅛"	1"
Collet capacity.....	1"	¾"	11/16"
Spindle centers.....	No. 3 Morse Taper	No. 3 Morse Taper	No. 3 Morse Taper
Size motor.....	1½ h.p.	1½ h.p.	1 h.p.

Toolroom Underneath Motor Driven Lathes

Catalog Number	Swing Over Bed Inches	Length of Bed Feet	Distance Between Centers Inches	Approx. Shipping Weight Pounds	Price f.o.b. Factory
16-INCH TOOLROOM UNDERNEATH BELT MOTOR DRIVEN LATHES					
8117-C	16¼	6	33½	2525	$2145.25
8117-D	16¼	7	45½	2605	2191.25
8117-E	16¼	8	57½	2685	2237.25
14½-INCH TOOLROOM UNDERNEATH BELT MOTOR DRIVEN LATHES					
8183-B	14⅝	5	24½	2180	$1843.25
8183-C	14⅝	6	36½	2255	1888.25
8183-D	14⅝	7	48½	2330	1933.25
8183-E	14⅝	8	60½	2405	1978.25
13-INCH TOOLROOM UNDERNEATH BELT MOTOR DRIVEN LATHES					
8113-B	13⅛	5	28	1665	$1577.25
8113-C	13⅛	6	40	1715	1617.25
8113-D	13⅛	7	52	1770	1657.25

South Bend Toolroom Lathes are equally efficient on precision toolroom work or close tolerance manufacturing operations. Their versatility reduces set-up time to a minimum. Smooth, vibration-free operation permits finish turning or boring with such precision that subsequent machine operations can often be eliminated. A convenient arrangement of controls makes for an ease of operation which reduces fatigue and lowers the probability of error. A wide range of spindle speeds permits machining work with maximum tool efficiency.

Improved Features include: alloy steel headstock spindle; replaceable headstock bearings; double wall apron; quick change gear box for threads and feeds; and semi-steel lathe bed.

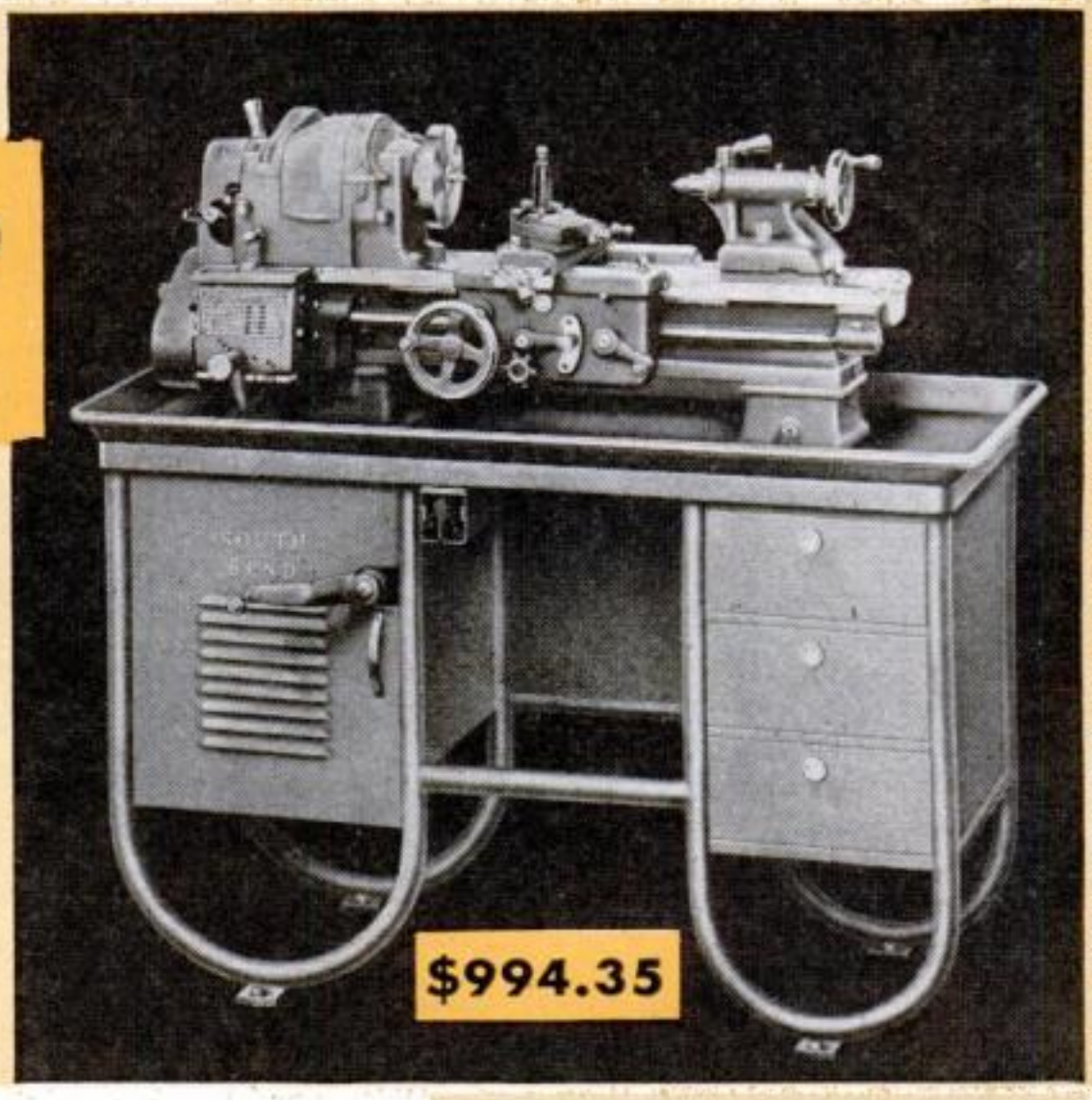
In Addition to 3-ph., 60 cy., 220 v., A.C. motor and drum control, and all equipment supplied with quick change gear lathe (see preceding page) the following toolroom attachments are included in price of lathe: handwheel type draw-in collet chuck attachment; collet rack; telescopic taper attachment; thread dial indicator; chip pan; and micrometer carriage stop. Chucks, tools, and collets are extra.

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SOUTH BEND

10″-1″ Collet Lathes

South Bend 10″ x 3′, 1″ Collet Quick Change Gear Bench Lathe



SPECIFICATIONS

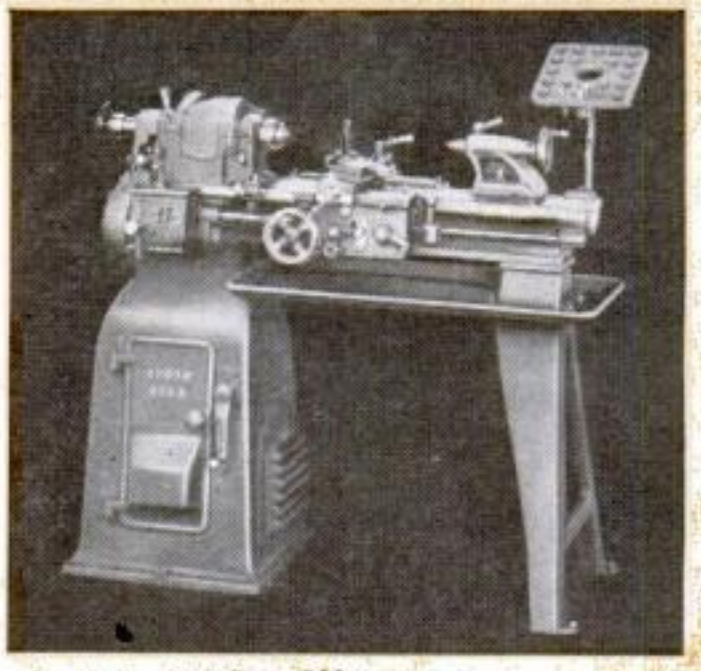
Swing over bed and saddle wings	10⅛″
Swing over saddle cross slide	5¾″
Spindle speeds (12)	50 to 1357 r.p.m.
Thread cutting range	4 to 224 R.H. or L.H.
Power longitudinal feeds	.0015″ to .0836″
Power cross-feeds	.0006″ to .0309″
Hole thru spindle	1⅜″
Collet capacity	1″
Spindle centers	No. 2 Morse Taper
Cross slide travel	5⅞″
Compound rest top slide travel	2″
Size motor	¾ h.p.

10-inch Swing South Bend Precision Lathes are capable of the most exacting operations on both tool and production work. This accuracy, together with their speed and versatility, contribute to lower machining costs. They contain all the design features that make the larger models so dependable.

Price includes 3 ph., 60 cy., 220 v., A.C. motor; drum control, and regular lathe equipment such as belts, centers, face plates, tool post, etc. Chucks and tools are extra. Toolroom Lathes also include: handwheel type draw-in collet attachment (without collets); collet rack; telescopic taper attachment; thread dial indicator; and micrometer carriage stop. Bench is included in price of bench lathe.

TIME PAYMENT TERMS

25% down, balance 12 mos., moderate finance charge (unless federal law requires otherwise)



South Bend 10″ x 3½′, 1″ Collet Toolroom Lathe **$1249.35**

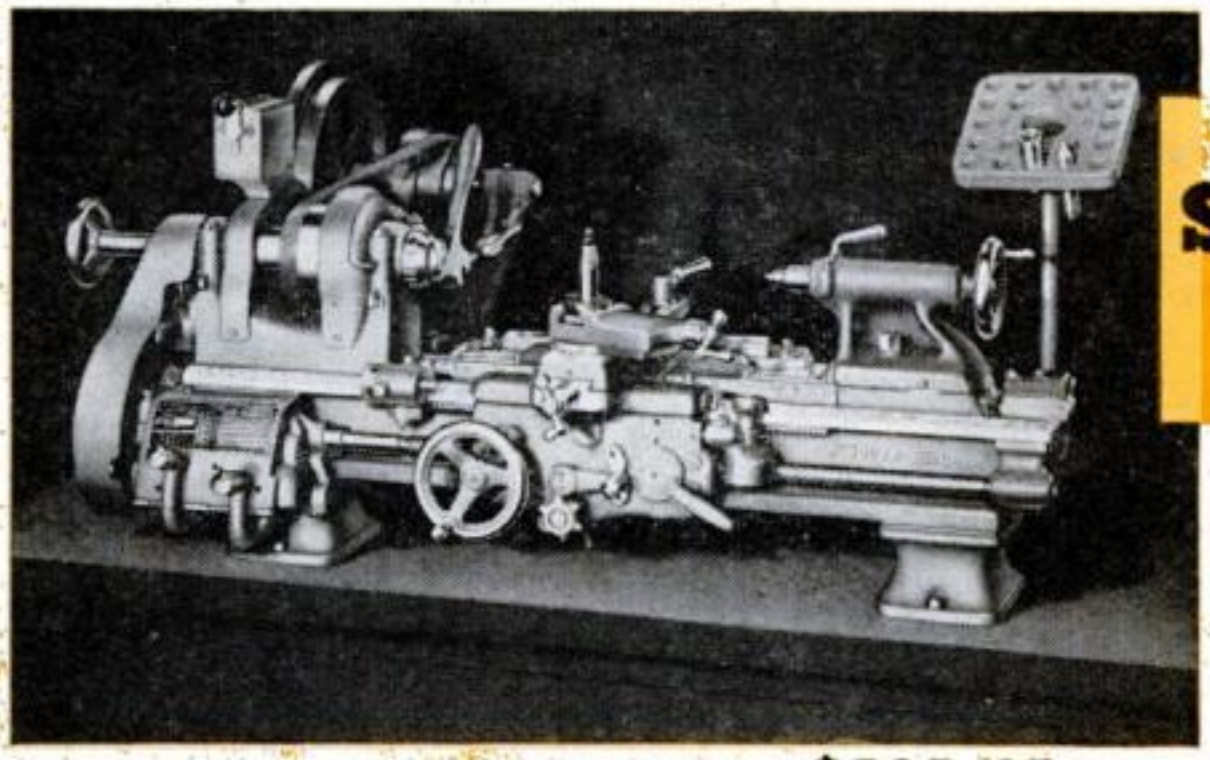
10″-1″ Collet Quick Change Gear and Toolroom Lathes

Catalog Number	Swing Over Bed Inches	Length of Bed Feet	Between Centers Inches	Shipping Weight Pounds	Price f.o.b. Factory
QUICK CHANGE GEAR BENCH LATHES					
187-YS	10⅛	3	14¾	850	$ 994.35
187-ZS	10⅛	3½	20¾	880	1011.35
187-AS	10⅛	4	26¾	950	1038.35
187-RS	10⅛	4½	32¾	980	1062.35
QUICK CHANGE GEAR LATHES WITH FLOOR LEGS					
187-Y	10⅛	3	14¾	810	$924.35
187-Z	10⅛	3½	20¾	835	941.35
187-A	10⅛	4	26¾	860	958.35
187-R	10⅛	4½	32¾	885	982.35

Catalog Number	Swing Over Bed Inches	Length of Bed Feet	Between Centers Inches	Shipping Weight Pounds	Price f.o.b. Factory
TOOLROOM BENCH LATHES					
8187-YS	10⅛	3	14¾	960	$1272.35
8187-ZS	10⅛	3½	20¾	990	1289.35
8187-AS	10⅛	4	26¾	1060	1316.35
TOOLROOM LATHES WITH FLOOR LEGS					
8187-Y	10⅛	3	14¾	935	$1231.35
8187-Z	10⅛	3½	20¾	960	1249.35
8187-A	10⅛	4	26¾	985	1267.35

SOUTH BEND LATHE WORKS, 524 E. Madison Street, South Bend 22, Indiana, U.S.A.

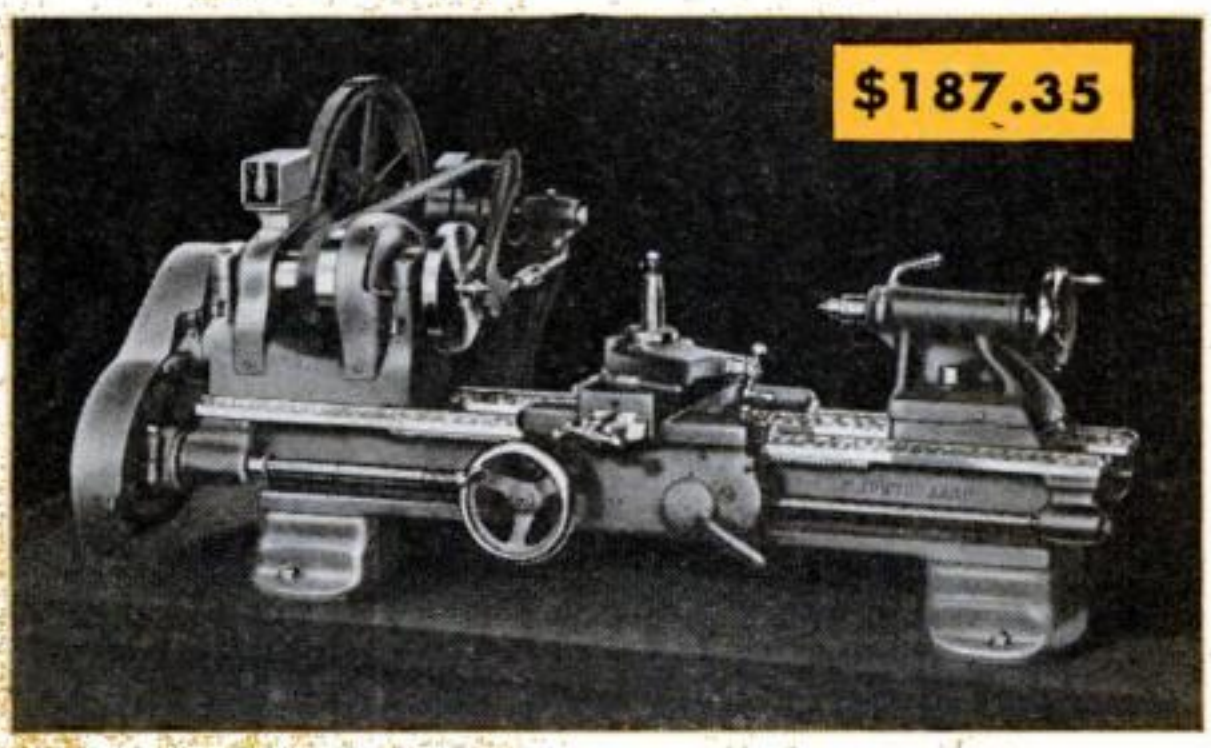
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South Bend 9" x 3' Toolroom Bench Lathe **$521.45**

SOUTH BEND

9-Inch Bench Lathes



South Bend 9" x 3' Model C Bench Lathe

SPECIFICATIONS

Swing over saddle wings.....9¼"
Swing over chip guard.....5½"
Spindle speeds:
6 speed drive.....41 to 658 r.p.m.
12 speed drive.....41 to 1270 r.p.m.
Thread cutting range:
Model A.....48 pitches R.H. or L.H. 4 to 224 per inch
Models B & C...45 pitches R.H. or L.H. 4 to 160 per inch
Power longitudinal feeds:
Model A.....48—.0015" to .0853"
Model B.....26—.0021" to .0155"
Model C.....14—.0021" to .0156"
Power cross feeds:
Model A.....48—.0004" to .0252"
Model B.....23—.001" to .0046"
Belt, width of pulley step for.....1"
Centers, Morse taper.....No. 2
Collet capacity, maximum.....½"
Headstock spindle hole.....¾"
Lead screw 29° Acme Thread.....¾"—8
Motor, size required:
For 6-speed drive.....¼ h.p.
For 12-speed drive.....½ h.p.
Spindle nose threads.....1½"—8
Tailstock top set over.....⅛"
Tool holder cutter bit.....¼" sq.
Tool holder shank.....⅜" x 13/16"
Approx. shipping weights:
3 ft. bed lathe.....355 lbs.
3½ ft. bed lathe.....380 lbs.
4 ft. bed lathe.....405 lbs.
4½ ft. bed lathe.....430 lbs.

Model A 9-inch Lathes have heat-treated alloy steel spindle, quick change gear box, and friction clutch worm drive for power longitudinal feeds and power cross-feeds.

Model B 9-inch Lathes are same as Model A Lathes except that they have independent change gears, instead of the quick change gear box, for threads and feeds.

Model C 9-inch Lathes are same as Model B Lathes except they do not have the worm drive for power feeds. The cross-feed is hand-operated, and longitudinal feeds are obtained by engaging half-nuts with the lead screw.

Toolroom 9-inch Lathes are same as Model A Lathes except that they have the following toolroom attachments: collet chuck; collet rack; taper attachment; thread dial; and micrometer carriage stop.

Price includes 1 ph., 60 cy., 115 v., A.C. instant reversing motor, drum control, and regular lathe equipment such as belts, centers, small face plate, tool post, etc. Chucks, collets, and tools are extra.

9-Inch Swing Horizontal Motor Driven South Bend Precision Bench Lathes

Length Bed Feet	Between Centers Inches	9" TOOLROOM LATHES		9" MODEL A LATHES				9" MODEL B LATHES				9" MODEL C LATHES			
				6-speed drive		12-speed drive		6-speed drive		12-speed drive		6-speed drive		12-speed drive	
		Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price
3	16	8644-Y	$521.45	444-Y	$298.35	644-Y	$340.45	477-Y	$240.35	677-Y	$282.45	415-YC	$187.35	615-YC	$229.45
3½	22	8644-Z	537.45	444-Z	314.35	644-Z	356.45	477-Z	256.35	677-Z	298.45	415-ZC	203.35	615-ZC	245.45
4	28	8644-A	553.45	444-A	330.35	644-A	372.45	477-A	272.35	677-A	314.45	415-AC	219.35	615-AC	261.45
4½	34	.....	.....	444-R	353.35	644-R	395.45	477-R	295.35	677-R	337.45	415-RC	242.35	615-RC	284.45

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9″ SOUTH BEND
V-Belt Horizontal Motor Driven Bench Lathes

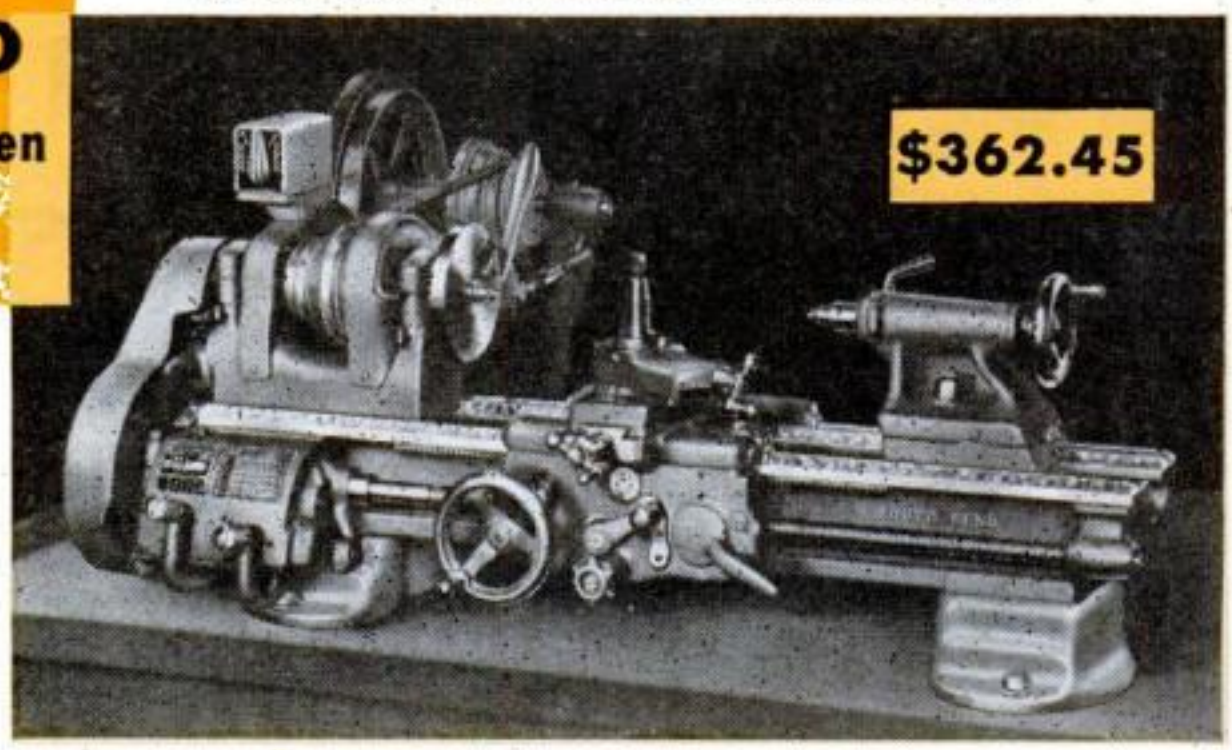
The 9″ Bench Lathes with 8-speed and 16-speed V-belt horizontal motor drives offer more spindle speeds—an advantage when surface speeds are critical. These lathes are identical in all other respects to those described on the preceding page.

Price includes 1 ph., 60 cy., 115 v., A.C. motor, drum control, and regular lathe equipment such as belt, centers, small face plate, tool post, etc. Chucks, collets, tools, and bench are extra.

TIME PAYMENT TERMS

25% down, balance 12 mos., moderate finance charge (unless federal law requires otherwise)

9″x3′ Model A Bench Lathe with 16-Speed V-Belt Drive



SPECIFICATIONS

Swing over saddle wings.....9¼″
Swing over chip guard.....5½″
Hole thru spindle.....¾″
Collet capacity.....½″
Spindle speeds
8 speed drive....46 to 609 r.p.m.
16 speed drive....46 to 1176 r.p.m.
Thread cutting range:
Model A.....48 pitches R.H. or L.H. 4 to 224 per inch.
Models B & C.45 pitches R.H. or L.H. 4 to 160 per inch.
Power longitudinal feeds
Model A.....48—.0015″ to .0853″
Model B.....26—.0021″ to .0155″
Model C.....14—.0021″ to .0156″
Power cross-feeds
Model A.....48—.0004″ to .0252″
Model B.....23—.001″ to .0046″
Spindle centers.....No. 2 Morse Taper
Size motors
8 speed drive.....¼ h.p.
16 speed drive.....½ h.p.

9-Inch Bench Lathes with V-Belt Horizontal Motor Drive

Length Bed Feet	Between Centers Inches	Ship. Wt. Crated Pounds	MODEL A				MODEL B				MODEL C			
			8-speed drive		16-speed drive		8-speed drive		16-speed drive		8-speed drive		16-speed drive	
			Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price
3	16	355	544-Y	$321.35	744-Y	$362.45	577-Y	$263.35	777-Y	$304.45	515-YC	$210.35	715-YC	$251.45
3½	22	380	544-Z	337.35	744-Z	378.45	577-Z	279.35	777-Z	320.45	515-ZC	226.35	715-ZC	267.45
4	28	405	544-A	353.35	744-A	394.45	577-A	295.35	777-A	336.45	515-AC	242.35	715-AC	283.45
4½	34	430	544-R	376.35	744-R	417.45	577-R	318.35	777-R	359.45	515-RC	265.35	715-RC	306.45



9″ SOUTH BEND
Underneath Motor Driven Lathe

Capable of machining work to the most exacting tolerances, this lathe is recommended for precision work in the toolroom, laboratory, or machine shop. Fully enclosed motor drive unit provides twelve spindle speeds, 41 to 1270 r.p.m. See above for other specifications. Price includes 1 ph., 60 cy., 115 v., A.C. motor, drum control, and regular lathe equipment. Chucks, collets, and tools are extra.

9″ Underneath Motor Driven Lathes

Catalog Number	Model	Length of Bed Feet	Between Centers Inches	Weight Crated Pounds	Price f.o.b. Factory
344-ZN	A	3½	22	570	$512.45
377-ZN	B	3½	22	560	454.45
8344-ZN	Toolroom	3½	22	630	693.45

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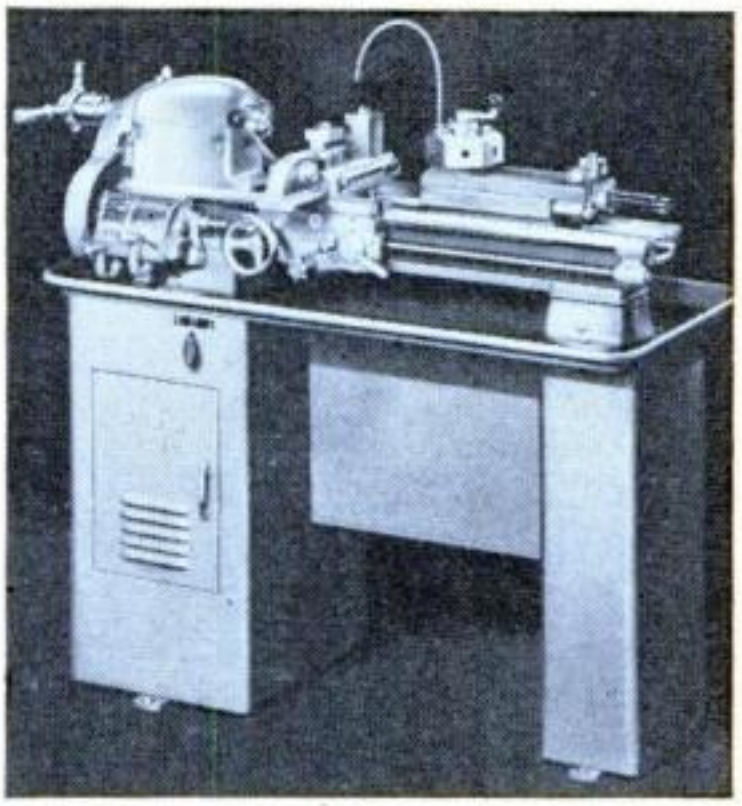
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SOUTH BEND

Precision Turret Lathes

SPECIFICATIONS	SERIES 900	SERIES 1000	SERIES 2-H
Collet capacity	½"	1"	1"
Hole thru spindle	¾"	1⅜"	1⅜"
Swing over bed and saddle wings	9¼"	10⅛"	16¼"
Swing over double tool-slide	3-9/16"	3-9/16"	6⅞"
Swing over compound slide	5½"	5⅞"	
Turret tool feed	4"	4"	6⅛"
Turret face to spindle distance, max	20⅝"	19⅜"	6' bed—28¼"
Double tool slide cross travel	3⅝"	3⅝"	9¾"
Thread cutting range, 48	4—224 per in.	4—224 per in.	4—224 per in.
Spindle speeds, 12	41-1270 r.p.m.	50—1357 r.p.m.	16-880 r.p.m.
Carriage power feeds: Longitudinal, 48	.0015"—.0853"	.0015"—.0836"	.0015"—.0841"
Transverse, 48	.0004"—.0252"	.0006"—.0309"	.0006"—.0312"
Carriage longitudinal travel	18"	16"	6' bed—22½"
Turret power feeds	.....	.....	.0001"—.0148"
Turret indexing tolerance at 4" from turret face	.0005"	.0005"	.0005"
Size motor	½ h.p.	¾ h.p.	2-1 h.p.

Series 900. This turret lathe is specifically designed for second operations on small, precision parts. Its accuracy, and speed of handling and machining produce appreciable economies in manufacturing that are not possible with heavy turret lathes. Price includes 1 ph., 60 cy., 115 v., A.C. motor, drum control, power feed universal carriage, handlever bed turret, handlever cross slide, compound rest cross slide, coolant return assembly, and metal column base with built-in oil pan.

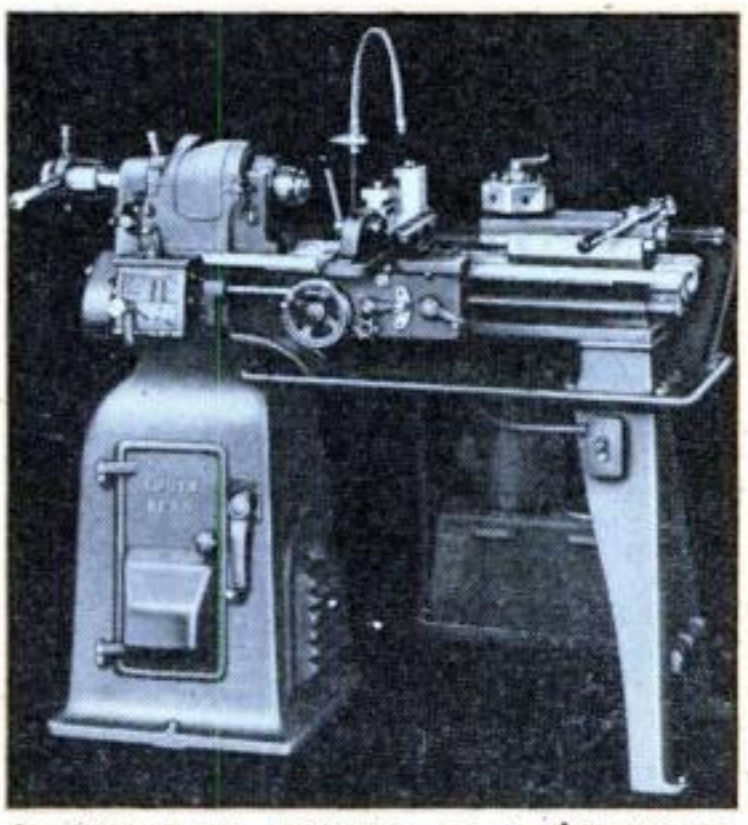


Ser. 900, Cat. No. 930-Z Turret Lathe **$805.45**

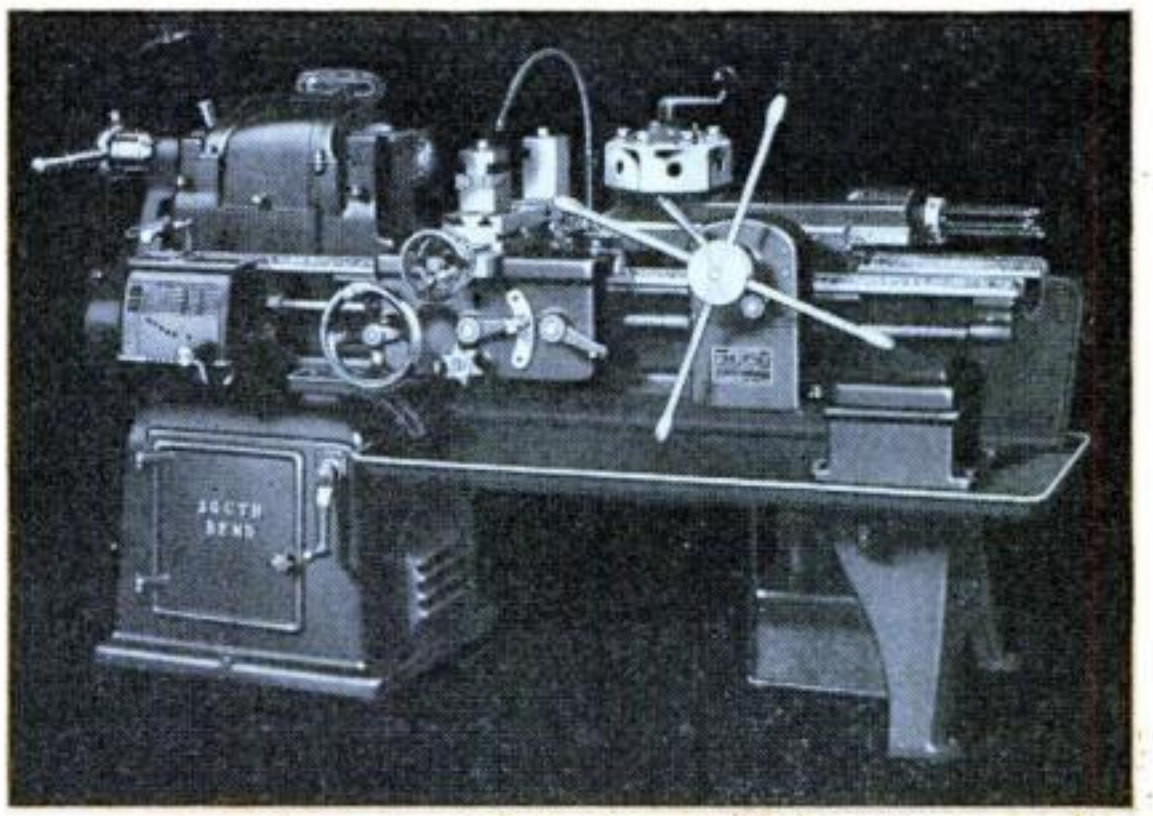
Series 1000. Designed for the same types of applications as the Series 900, these turret lathes with their larger capacities are ideal for machining a wide variety of precision parts. Numerous choices of spindle speeds, power longitudinal and transverse carriage feeds, and thread cutting feeds keep production efficient. Price includes 3 ph., 60 cy., 220 v., A.C. motor, drum control, power feed universal carriage, handlever bed turret, handlever cross slide, compound rest cross slide, oil pan, and coolant return assembly.

Series 2-H. The production of precision duplicate parts in both machine shops and toolrooms is simplified with 2-H Turret Lathes. They are especially suited for exacting second operations on large work because of their accuracy and ease of operation. Price includes 2-speed, 3 ph., 60 cy., 220 v., A.C. motor, drum control, power feed universal carriage with screw feed double tool slide having front and rear tool blocks, power feed ram-type turret, and oil pan.

Prices do not include coolant pump, splash pan or collet equipment.



Ser. 1000, Cat. No. 1006-Z Turret Lathe **$1279.35**



Series 2-H, Cat. No. 2-CT Turret Lathe (6' bed) **$2692.35**

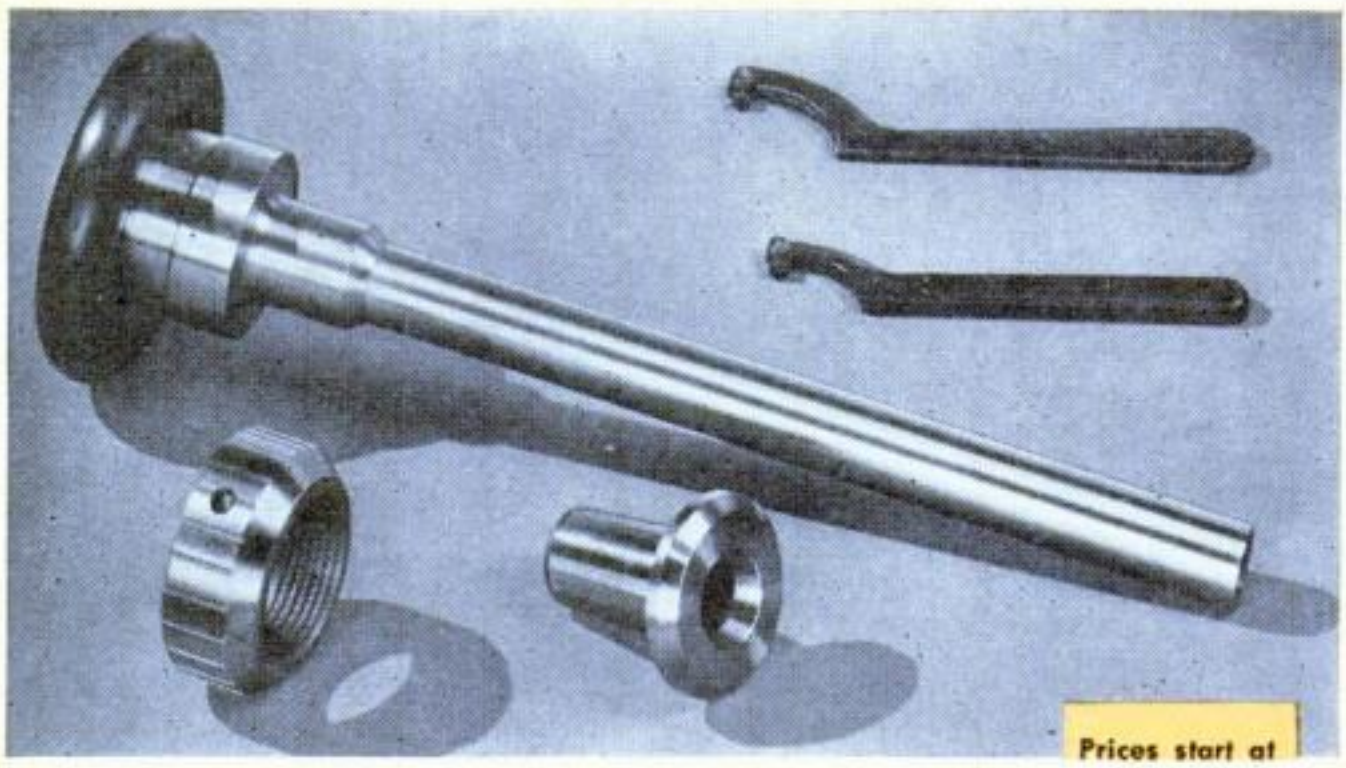
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HANDLEVER COLLET ATTACHMENT

The Handlever Collet Attachment is an aid to rapid production work. Stock can be released and fed through the collet without stopping the lathe.



Handwheel Draw-in Collet Attachment

Prices start at **$26**

Collet Attachment

HANDWHEEL TYPE

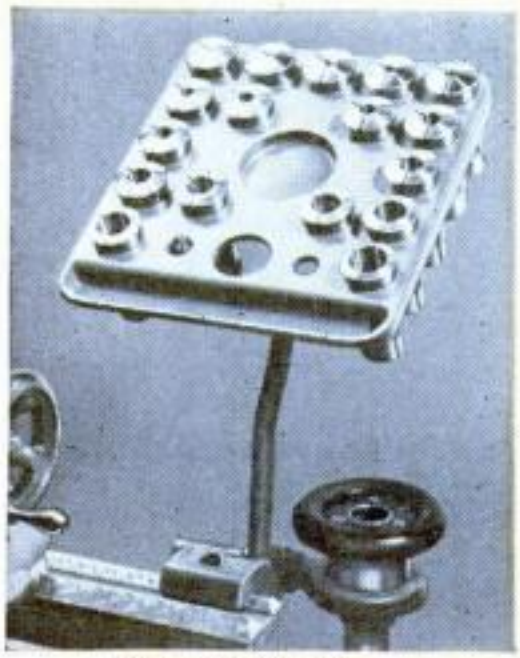
The Handwheel Collet Attachment is a very accurate type of chuck. It is used for precision toolroom work and for the manufacture of small parts, or wherever extremely close tolerances are required. Bar and tube stock can be fed through the hollow draw-bar that operates the collet. Equipment includes draw-bar, spindle nose cap, spanner wrench, and closing sleeve. Collets are not included.

DRAW-IN COLLET ATTACHMENTS

Size of Lathe	Collet Required	Max. Collet Cap.	Handwheel Type Catalog Number	Handwheel Type Price	Handlever Type Catalog Number	Handlever Type Price
9" and Series 900	No. 3	½"	4306-W	$26	5206-W	$ 89
10"—11/16" Collet	No. 2	11/16"	4310	42	5210	126
10"—1" Col. & Series 1000	No. 5	1"	4312	52	5219	158
13"—11/16" Collet	No. 2	11/16"	4313	42	5213	126
13"—1" Collet	No. 5	1"	4313-Q	52	5213-Q	158
14½"—¾" Collet	No. 4	¾"	4314	47	5214	147
14½"—1" Collet	No. 5	1"	4314-M	52	5214-M	158
16", 16/24", & No. 2-H	No. 5	1"	4316	52	5216	158

Collet Rack and Collet Chest

Collet Rack No. 1770-W holds 19 collets, all others hold 17 collets. Collets are not included.



COLLET RACK

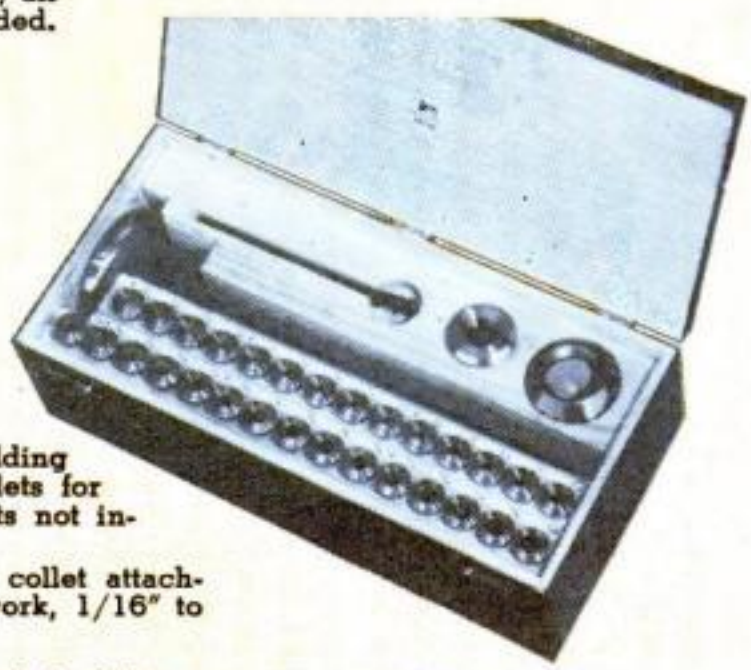
Holds collets, centers, spindle sleeve, draw-bar, spindle nose cap, wrench, etc.

COLLET RACKS

Catalog Number	Size of Lathe	Price
1770-W	9" and 900	$13
1752	10"—11/16" Col.	16
1753	10"—1" C & 1000	18
1772	13"—11/16" Col.	16
1772-Q	13"—1" Col.	18
1791	14½"—¾" Col.	18
1774	14½", 16" & 16/24"	18

No. 2225—Collet Chest only, for holding handwheel collet attachment and collets for 9" lathe. Collet attachment and collets not included. Price: $7.50.

No. 2220—Collet Chest, 9" handwheel collet attachment and 29 steel collets for round work, 1/16" to ½" by 64ths. Complete: $123.00.



COLLET CHEST

Holds handwheel collet attachment and 29 collets. Well constructed of wood.

TIME PAYMENT TERMS

When order includes lathe, 25% down, balance 12 mos., moderate finance charge (unless federal law requires otherwise)

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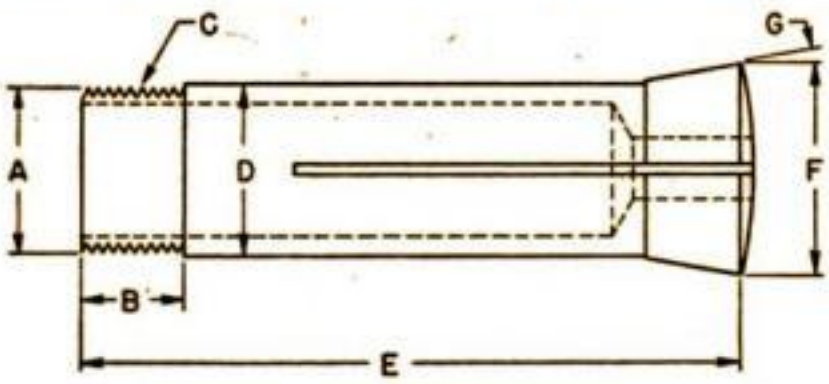
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Collets and Collet Sets

South Bend Collets, manufactured with the same exacting care as South Bend Lathes, deliver long, dependable service on precision work. Each collet is carefully inspected and tested, and packed in substantial plastic box with transparent lid through which the size can be read for easy selection.

Steel Collets are carefully heat-treated for maximum service and are precision ground to exceedingly close tolerances.

Brass Collets, a South Bend innovation, have many practical applications. Their low cost makes them desirable for odd sizes that are used only occasionally. They can be readily machined on the job for holding tapered or irregular shapes. When worn, they can be rebored to larger diameters.




Steel Collet


Brass Collet


Collet Packaged in Plastic Box

Specifications of Steel and Brass Collets

Collet Number	* For South Bend Lathes	A Thread Diameter Inches	B Thread Length Inches	C Threads Per Inch	D Body Diameter Inches	E Collet Length Inches	F Head Diameter Inches	G Head Angle Degrees
3	9" and Series 900	.650	3/4	26	.6495	2-11/16	.852	12
2	10" and 13"—11/16" Collet	.855	13/16	20	.8595	3-5/16	1.095	15
5	10", 13", 14½", 16"—1" Collet. 16/24", 2-H, 1000	1.250	3/4	20	1.2495	3-9/32	1.452	10
4	14½"—¾" Collet	.950	13/16	20	.9495	3	1.150	10

*Collets can also be used on any other lathe or machine which they will fit.

South Bend Collets and Collet Sets

Collet	Description	Steel Collets Cat. No.	Steel Collets Price	Brass Collets Cat. No.	Brass Collets Price
No. 3	1 Collet, any standard size 1/16" to 1/2" in 64ths	609-W	$ 3.75	1696	$ 2.00
	Set of 8 Collets in 16ths, 1/16" to 1/2"	2047	27.00	2235	15.00
	Set of 7 Collets in odd 32nds, 3/32" to 15/32"	2476	24.00	2534	13.00
	Set of 14 Collets in odd 64ths, 5/64" to 31/64"	2477	46.00	2535	24.00
	Decimal Collets (.0625" to .500") each	769-W	4.00	1856	2.15
	Metric Collets (1.5 mm to 12.5 mm) each	773-W	4.00	1702	2.15
No. 2	1 Collet, any standard size 1/16" to 11/16" in 64ths	1721	4.00	1697	2.25
	Set of 11 Collets in 16ths, 1/16" to 11/16"	2432	39.00	2238	23.00
	Set of 10 Collets in odd 32nds, 3/32" to 21/32"	2478	36.00	2536	21.00
	Set of 20 Collets in odd 64ths, 5/64" to 43/64"	2479	71.00	2537	40.00
	Decimal Collets (.0625" to .6875") each	769-N	4.25	1857	2.40
	Metric Collets (1.5 mm to 17.0 mm) each	773-N	4.25	1703	2.40
No. 5	1 Collet, any standard size 1/16" to 1" in 64ths	1722	4.75	1698	2.50
	Set of 16 Collets in 16ths, 1/16" to 1"	2435	68.00	2241	37.00
	Set of 15 Collets in odd 32nds, 3/32" to 31/32"	2482	64.00	2540	35.00
	Set of 30 Collets in odd 64ths, 5/64" to 63/64"	2483	127.00	2541	65.00
	Decimal Collets (.0625" to 1.000") each	769-R	5.00	1858	2.65
	Metric Collets (1.5 mm to 25.0 mm) each	773-R	5.00	1704	2.65
No. 4	1 Collet, any standard size 1/16" to 3/4" in 64ths	1713	4.25	1699	2.35
	Set of 12 Collets in 16ths, 1/16" to 3/4"	2438	46.00	2244	26.00
	Set of 11 Collets in odd 32nds, 3/32" to 23/32"	2480	42.00	2538	24.00
	Set of 22 Collets in odd 64ths, 5/64" to 47/64"	2481	81.00	2539	45.00
	Decimal Collets (.0625 to .7500") each	769-K	4.50	1859	2.50
	Metric Collets (1.5 mm to 19.0 mm) each	773-K	4.50	1705	2.50

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Chuck and Tool Assortments

The chucks and tools in the assortments shown are recommended for use with the various South Bend Lathes. This is the basic equipment required for the average shop for general machine work, such as turning, boring, drilling, cutting-off, chucking, etc. A 3-jaw Universal chuck can be substituted for the 4-jaw Independent at additional cost.



Contents of Assortment

4-Jaw Independent Lathe Chuck fitted to lathe. Sizes: 6 in. on 9" and 10" Lathes; 7½ in. on 13" Lathe; 9 in. on 14½" Lathe; 10 in. on 16" and 16/24" Lathes.
Jacobs 3-Jaw Drill Chuck. Sizes: ½ in. on 9" and 10" Lathes; ¾ in. on 13" and 14½" Lathes; 1 in. on 16" and 16/24" Lathes.
Arbor Fitted to Above Drill Chuck.
Straight Shank Tool Holder.
6 Ground Cutter Bits for Tool Holder.
Boring Tool Holder, Style "B." 9" Lathes take Style "D."
Cutting-Off Tool Holder, Right-Hand.
4 Malleable Lathe Dogs. Sizes: ½", ¾", 1", and 1¼" on 9" and 10" Lathes; ½", ¾", 1", and 1½" on all others.

Prices of Complete Assortments

Size of Lathe	Catalog No.	Price
9" & 900	105-WT	$53.89
10"—11/16" Collet	110-T	92.72
10"—1" Collet & 1000	110-L	93.72
13"—11/16" Collet	113-T	109.41
13"—1" Collet	113-TQ	110.41
14½"—¾" Collet	114-T	123.28
14½"—1" Collet	114-TM	136.28
16" & 16/24"	116-T	144.28

Wood Turning Rest

Mounts on compound rest base to convert lathe for wood turning. See page 14 for wood turning centers.

Price includes socket and two T-rests, 4" and 12" wide.

Prices Start At $10



Size of Lathe	Catalog No.	Price
9"	896-W	$10
10"	1069	13
13"	1073	15
14½"	1165	19
16" and 16/24"	1075	19

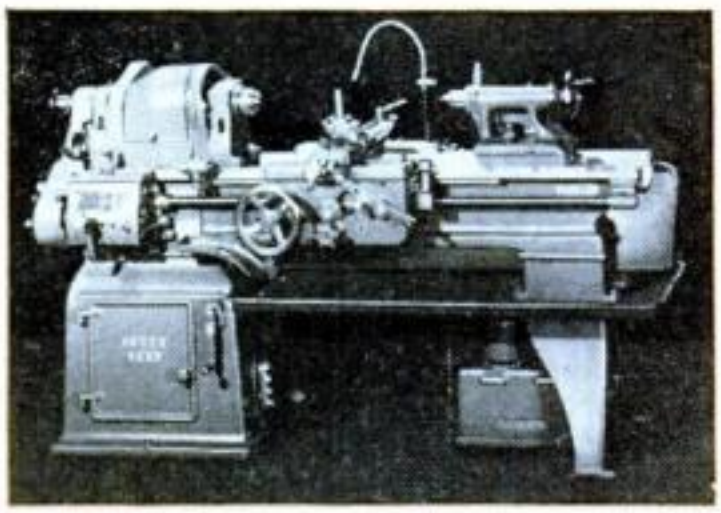


Pipe Centers

Cat. No.	Takes Pipe	Requires Shank	Price
2160	½" to 3"	2172-NR or 2172-TH	$4.75
2161	3" to 5"	2173-TH	6.50
2162	5" to 8"		9.75

Pipe Center Shanks

Cat. No.	Taper	Price
2172-NR	No. 2	$4.75
2172-TH	No. 3	4.75
2173-TH	No. 3	8.00



Chip Pans and Oil Pans

Oil Pans, Splash Pans, and Chip Pans can be supplied for all South Bend Lathes. Oil Pans should be factory-installed for proper fit. Complete information and prices will be supplied on request.

TIME PAYMENT TERMS

When order includes lathe 25% down balance 12 mos., moderate finance charge (unless federal law requires otherwise)

SOUTH BEND LATHE WORKS, 524 E. Madison Street, South Bend 22, Indiana, U.S.A.

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Milling and Keyway Cutting Attachment



Milling and Keyway Cutting Attachment

This useful attachment is ideal for shops not having enough of this work to justify a milling machine. Mounts on compound rest base of lathe, permitting the power cross and longitudinal feeds to be used for milling, boring and keyway cutting operations on work held in the milling attachment vise. Vise swivels in any direction, 180° horizontal and vertical graduations. Vertical slide adjusting screw equipped with micrometer graduated collar.

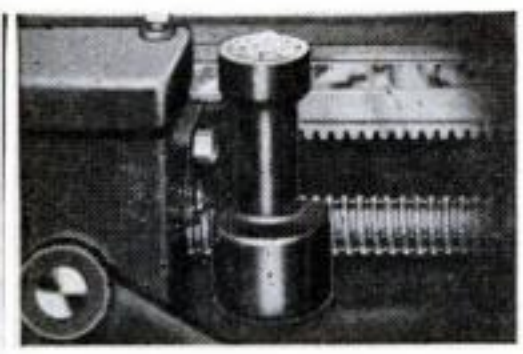
Size Lathe	Cat. No.	Vise Cap.	Price
9" & 900	9-W	1½"	$37
10" & 1000	1-N	1¾"	47
13"	3	2⅞"	58
14½"	4-K	4"	68
16", 16/24"	5	4"	79

Arbors for Milling Cutters



Holds cutters with 1" holes. Capacity between nut and shoulder, 1½". 3 spacing collars furnished. All shanks No. 3 Morse Taper.

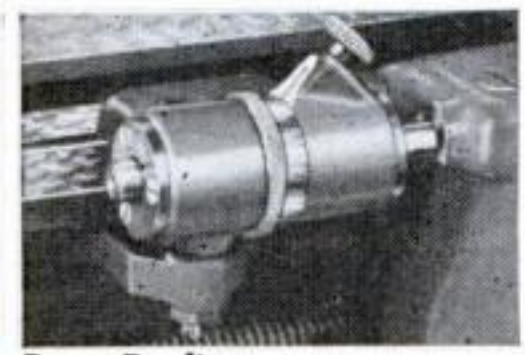
Lathe Size	Catalog No.	Price
9" & 900	109-NH	$7.50
10" & 1000	109-NH	7.50
13"	109-NH	7.50
14½"	109-NH	7.50
16", 16/24",	109-NH	7.50



Thread Dial Indicator

Eliminates reversing of lathe spindle when cutting threads. Dial is numbered and graduated to show when to close half-nuts on lead screw to catch the thread on the next successive cut, after returning carriage to starting point.

Lathe Size	Catalog No.	Price
9" & 900	810-W	$ 9
10" & 1000	1588	14
13"	813	16
14½"	813	16
16", 16/24", 2-H	813	16

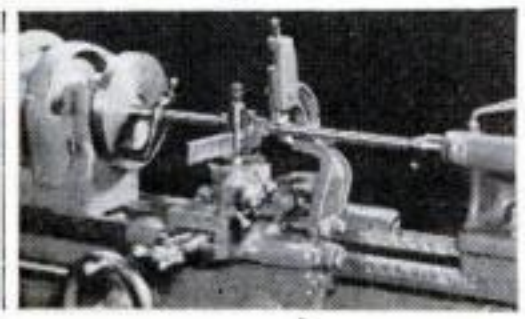


Micrometer Carriage Stop

Locates the carriage at any point along the bed for accurate facing, turning, boring, etc. Has accurately graduated micrometer collar. Stop is hardened on both ends for use on either side of carriage. Can be locked for duplicate work.

Size of Lathe	Catalog No.	Price
9" & 900	968-W	$16
10" & 1000	1518	17
13"	973	19
14½"	975-FH	20
16", 16/24", 2-H	975-FH	20

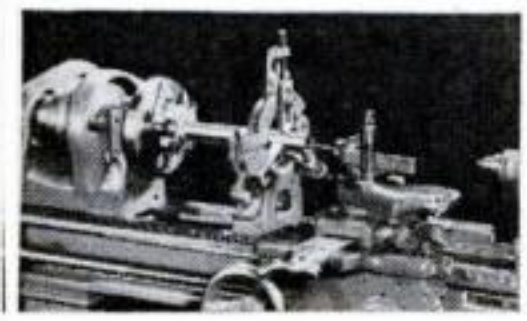
Patent Pending



Follower Rest

Supports long, slender shafts being machined between centers. Attaches to, and travels with, the carriage. Adjusting screws and lock screws are provided for setting the jaws in position. Slots in bottom of follower rest permit quick attachment or removal.

Size of Lathe	Catalog No.	Capacity		Price
		Max.	Min.	
9" & 900	34-W	2"	3/16"	$5.00
10" & 1000	1353	2½"	3/16"	7.50
13"	376	3¼"	3/16"	8.50
14½"	1351	4¼"	3/16"	10.00
16"	730	4¼"	3/16"	11.00
16/24"	1352	4¼"	3/16"	16.00



Center Rest

Clamps on inside ways of lathe bed and is used for supporting long shafts, boring spindles, etc. The 3 jaws are adjustable, and are made of cast iron. Top of center rest is hinged to facilitate inserting and removing shafts.

Size of Lathe	Catalog No.	Capacity		Price
		Max.	Min.	
9" & 900	125-W	3"	¼"	$7.50
10" & 1000	1177	3"	¼"	11.00
13"	341	3¾"	⅜"	14.00
14½"	1174	4¾"	⅜"	17.00
16"	720	4¾"	⅜"	19.00
16/24"	1175	4¾"	⅜"	26.00

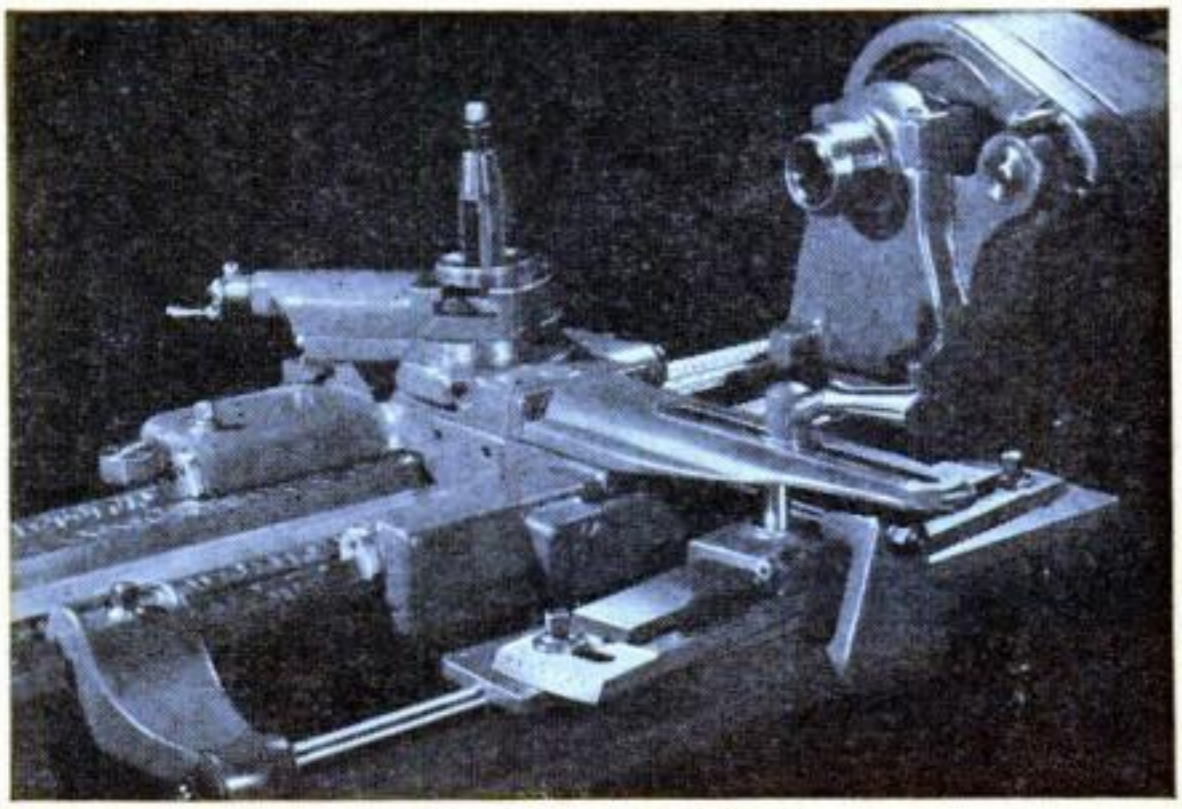
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Taper Attachments

Telescopic and Plain

Taper turning and boring are as easily accomplished as straight turning on lathes equipped with South Bend Taper Attachments. The Taper Attachments are permanently mounted on the lathe carriages, and must be fitted at the factory. Accuracy and smooth operation are assured by their practical design and rugged construction. The swivel bar is graduated in both degrees and taper per foot.

Telescopic Taper Attachments are used only on 10" and larger lathes. A telescopic cross-feed screw eliminates the necessity of disconnecting the cross-feed nut when tapers are machined. The Plain Taper Attachment used on 9" Lathes requires the disconnecting of the cross-feed screw and nut.

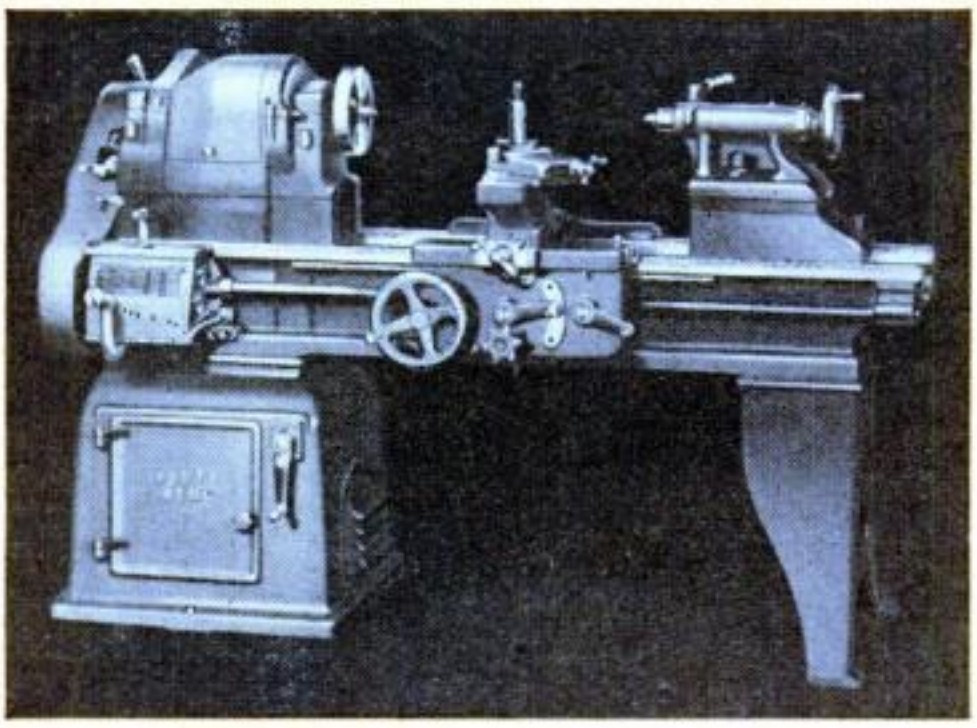


Telescopic Taper Attachment

Size of Lathe	Catalog Number	Max. Length at One Setting	Max. Taper per Foot	Max. Taper in Degrees	Price
9" and 900....	428-W	7"	3½"	16½	$ 80
10" & 1000....	1545	8½"	3½"	16½	145
13".....	379	9¼"	3½"	16½	165
14½".....	399	9¼"	3½"	16½	177
16" & 16/24"..	381	11½"	3½"	16½	198

TIME PAYMENT TERMS

When order includes lathe 25% down, balance 12 mos., moderate finance charge (unless federal law requires otherwise)

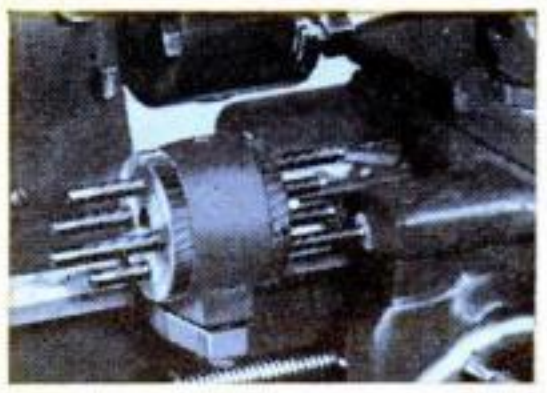


16/24" Quick Change Gear Lathe

This lathe has ample capacity for large, awkward jobs such as wheels, fly wheels, brake drums, etc.; yet, it is not too heavy or cumbersome for efficient operation on small parts. Takes 24¼" over bed and 18¾" over saddle cross slide. Other specifications are same as for 16" lathes on page 2.

Cat. No. 198-E—16/24" x 8' Quick Change Gear Lathe with 3 ph., 60 cy., 220 v. A.C. motor and drum switch..... $2028.25

Prices of same lathe with 6', 7', 10', or 12' bed on request.



Four Position Carriage Stop

Used to position cutting tools for repetitive operations. Has four stop screws. Each may be set for a different tool position. Especially useful with a square turret tool block carrying four cutting tools. Clamps to bed on either side of lathe carriage.

Cat. No.	Size of Lathe	Price
2185-N	9".....	$18
2185-R	10".....	20
2185-T	13".....	21
2185-F	14½".....	22
2185-H	16", 16/24", 2-H..	23

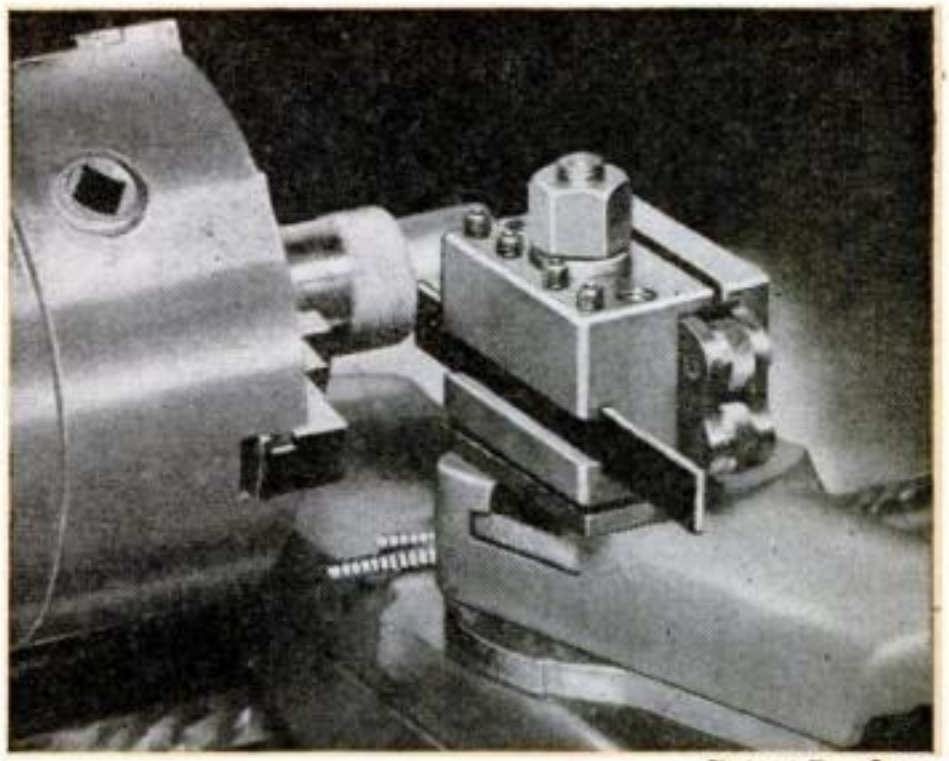
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Universal Tool Block

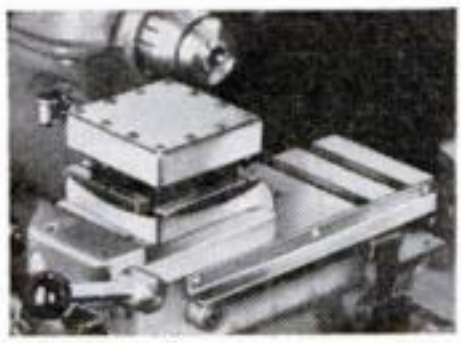
The new Universal Tool Block replaces the conventional tool post and various tool holders ordinarily used for general lathe work. It provides rigid support for turning, boring, threading, and cut-off tool bits. In addition, it is equipped with a self-aligning knurling head. Screw adjustments for tool height are easily made, and they stay put. No readjustment is required when replacing tools. This tool block can be adapted to fit other makes of lathes.

Size of Lathe	Cat. No.	Price
9".....	1413-N	$11.80
10".....	1413-R	12.50
13".....	1413-T	14.50
14½".....	1413-F	16.50
16" & 16/24"	1413-H	17.00



Patent Pending

Universal Tool Block



Patent Pending

Square Turret Tool Block

for Double Tool Cross Slide

The turret indexes within .0005", permitting each of four tools to be used in sequence for rough turning, finish turning, facing, boring, cutting-off, or other operations as required. A quick-acting lever locks the turret securely in each of the four positions. Rocker adjustment is provided for adjusting height of each tool. For use on the double tool cross slides of South Bend Lathes, but can be adapted for use on other makes.

Tool Blocks for Double Tool Cross Slides

Size of Lathe	Catalog Number	Size Square	Takes Tools	Price
9" & 900.....	41-ND	3"	⅜" x ⅜"	$42
10" & 1000.....	41-ND	3"	⅜" x ⅜"	42
16".....	42-ND	4"	⅝" x ⅝"	75



Patent Pending

Square Turret Tool Block

for Compound Cross Slide

Used on compound cross slides for same purpose as tool block described at left. Turret indexes within .0005" to each of four positions and locks by means of lever. Rocker adjustments provided for tools. Ruggedly constructed. This tool block is for use on compound rest cross slides of South Bend Lathes but can be adapted for use on other makes.

Tool Blocks for Compound Cross Slides

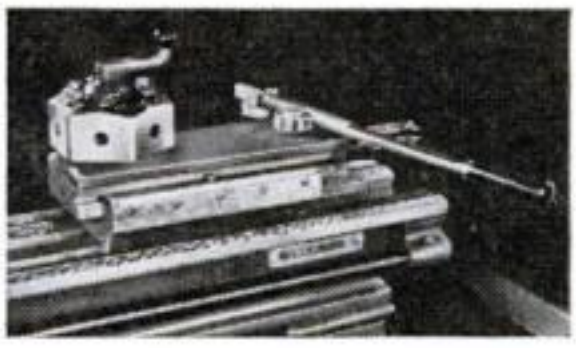
Size of Lathe	Catalog Number	Size Square	Takes Tools	Price
9" & 900.....	40-NC	3"	⅜" x ⅜"	$48
10" & 1000.....	41-NC	3"	⅜" x ⅜"	48
13".....	43-NC	3"	⅜" x ⅜"	53
14½".....	44-NC	4"	⅝" x ⅝"	75
16" & 16/24".....	42-NC	4"	⅝" x ⅝"	80



Handlever Double Tool Cross Slide

Ideal for increasing production on repetitive operations. Three 7/16" square cutter bits can be used—two in front tool block, one in rear tool block. Mounts on saddle cross slide in place of compound rest. Can be operated by handlever or power cross-feed.

Size of Lathe	Catalog Number	Swing over Slide	Price
9" & 900..	2030-W	3-9/16"	$79
10" & 1000.	2031	3-9/16"	95



Handlever Bed Turret

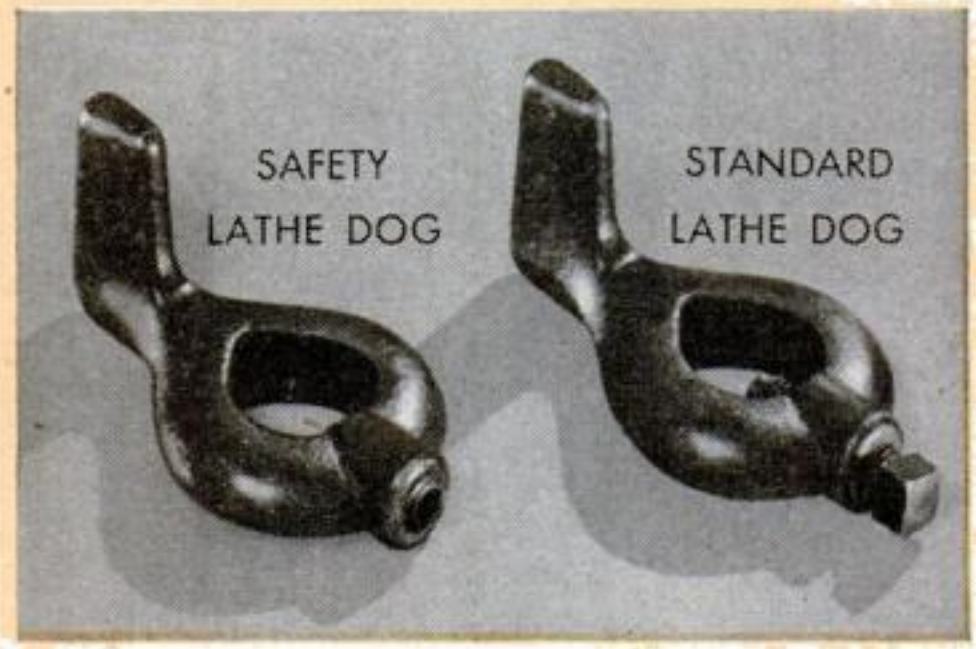
Turret head indexes automatically when lever is moved to extreme right. Each turret face has independently adjustable feed stop screw which accurately regulates length of cut. Effective feed of turret slide 4". Turret indexes within .0005" four inches from turret face.

Size of Lathe	Cat. No.	Price
9" & 900.....	1611-W	$210
10" & 1000....	1612	220
13".....	1613	237

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Standard and Safety Lathe Dogs

Lathe dogs should correspond in capacity to the diameter of the work if the work is to be held securely. These lathe dogs are made of heavy malleable iron and are properly designed for maximum strength and long service. The Standard Lathe Dog has square head alloy steel set screw. The Safety Lathe Dog has a headless alloy steel set screw.



Lathe Dogs for 13" and Larger Lathes

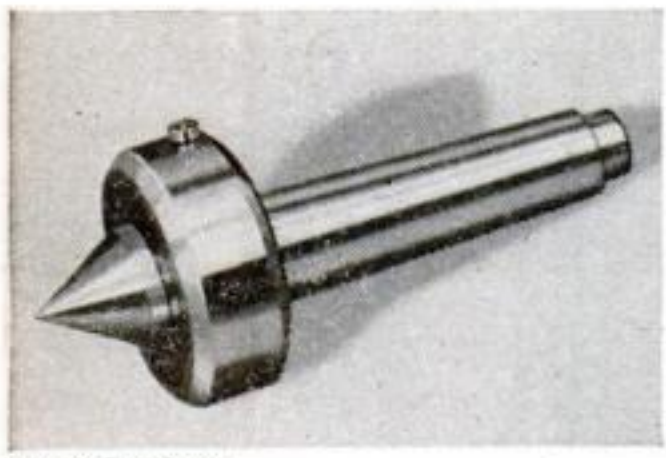
Cap. In.	STANDARD Cat. No.	STANDARD Price	SAFETY Cat. No.	SAFETY Wrench Required	SAFETY Price
½	3843	$0.85	3826	2385	$0.85
¾	3844	1.00	3827	2386	1.00
1	3845	1.10	3828	2387	1.10
1¼	3846	1.25	3829	2388	1.25
1½	3847	1.50	3830	2389	1.50
1¾	3848	1.65	3831	2389	1.65
2	3849	1.80	3832	2389	1.80
2½	3850	2.05	3833	2390	2.05
3	3851	2.30	3834	2390	2.30
3½	3852	3.15	3835	2390	3.15
4	3853	4.25	3836	2390	4.25

Lathe Dogs for 9" and 10" Lathes

Cap. In.	STANDARD Cat. No.	STANDARD Price	SAFETY Cat. No.	SAFETY Wrench Required	SAFETY Price
⅜	3837	$0.75	3820	2385	$0.75
½	3838	.80	3821	2385	.80
¾	3839	.95	3822	2386	.95
1	3840	1.05	3823	2387	1.05
1¼	3841	1.15	3824	2388	1.15
1½	3842	1.45	3825	2388	1.45

A complete set of lathe dogs is a must in any shop.

Lathe Centers and Drill Pads



Patent Pending

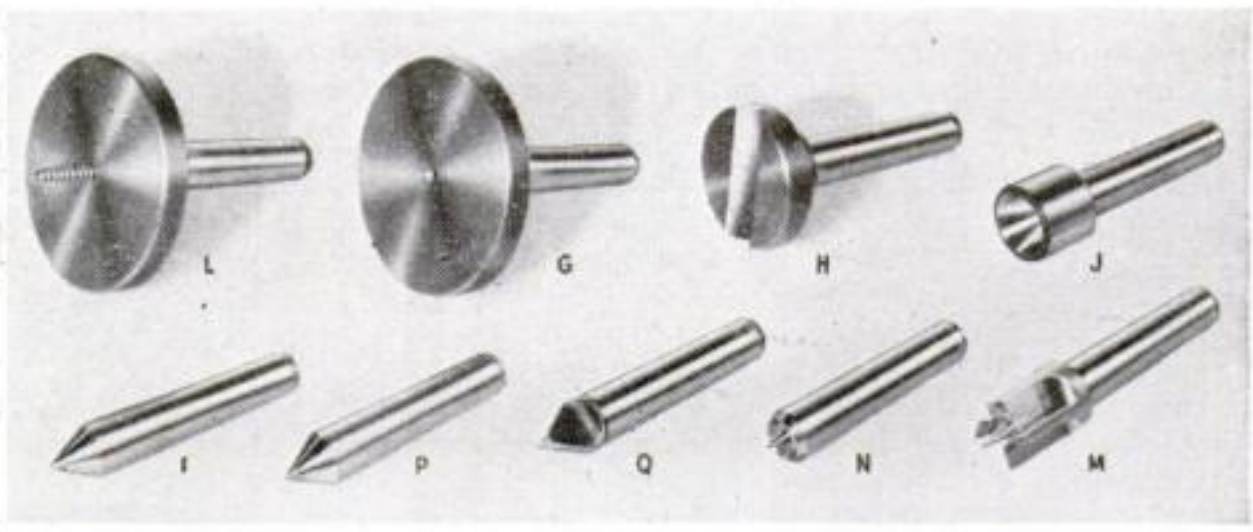
Ball Bearing Live Center

Designed for maximum strength and rigidity, the Ball Bearing Live Center is recommended for high speeds, heavy roughing cuts, etc. 60° point runs in substantial precision ball bearing which is easily replaceable.

Catalog No.	Shank Taper	Price
3900	No. 2	$13.75
3901	No. 3	16.25

TIME PAYMENT TERMS

When order includes lathe 25% down, balance 12 mos., moderate finance charge (unless federal law requires otherwise)



L—Screw Center for wood turning. G—Drill Pad to support flat work for drilling. H—Crotch Center supports round work for cross drilling. J—Hollow Center for supporting centerless shafts up to ⅞" dia. I—60° Center for headstock or tailstock spindles P—Carbide Center. Q—Half Center. N—Cup Center. M—Spur Center, for all wood turning operations.

Description	No. 2 Taper for 9" and 10" Lathes Cat. No.	No. 2 Taper for 9" and 10" Lathes Price	No. 3 Taper for 13", 14½", & 16" Cat. No.	No. 3 Taper for 13", 14½", & 16" Price
L—Screw Center	731-NR	$3.15	731-TH	$3.50
G—Drill Pad	727-NR	2.65	727-TH	2.90
H—Crotch Center	728-NR	2.65	728-TH	3.50
J—Hollow Center	1896-NR	2.15	1896-TH	2.90
I—60° Center	726-NR	2.40	726-TH	3.15
P—Carbide Center	1889	4.75	1890	8.50
Q—Half Center	926-NR	2.40	926-TH	3.15
N—Cup Center	733-NR	2.15	733-TH	2.90
M—Spur Center	732-NR	3.15	732-TH	3.50

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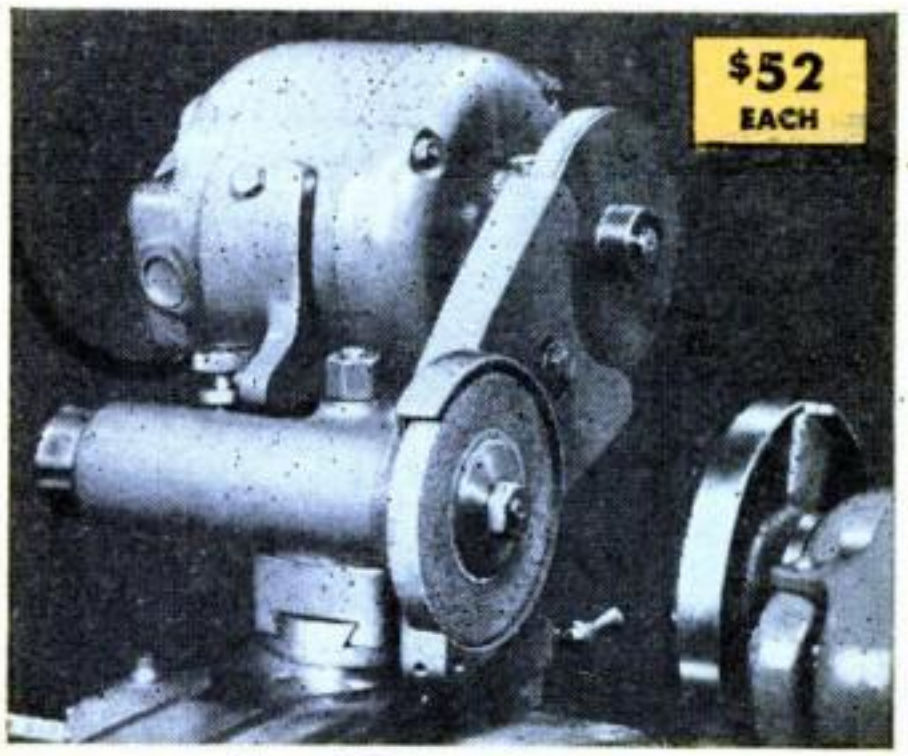
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Grinding Attachment

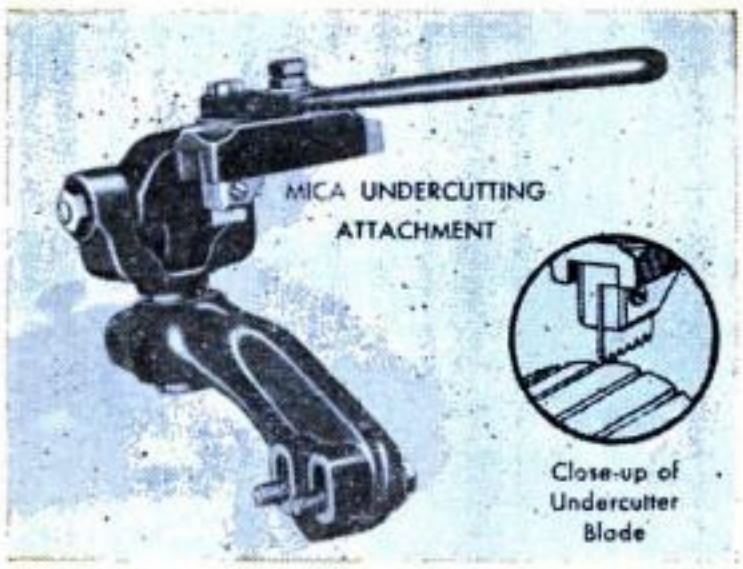
This powerful and efficient grinding attachment is recommended for external grinding. Designed to fit the various sizes of South Bend Lathes, it is easily adaptable for use on milling machines, shapers, planers, or other makes of lathes. The spindle revolves on pre-lubricated, precision ball bearings which are sealed to protect them from damage by dust, grit, and metal particles produced when grinding. Supplied with ¼ h.p., 1725 r.p.m., 115 v., 60 cy., 1 ph. motor and 4" x ½" grinding wheel.

Prices with other motors quoted on request.

Catalog No.	Size of Lathe	Price
301-BN	9" & Series 900	$52
301-BR	10" & Series 1000	52
301-BT	13"	52
301-BF	14½"	52
301-BH	16" & 16/24"	52



External Grinding Attachment



Patented

Mica Undercutting Attachment

Any shop that repairs armatures for motors, generators or starters will have a lot of use for this practical attachment. It attaches to the saddle of the lathe which insures rigidity and alignment. The blade travels parallel to the commutator bars which insures clean, straight cutting. Upper portion is hinged so the blade holder can be swung back so it does not interfere with turning the commutator.

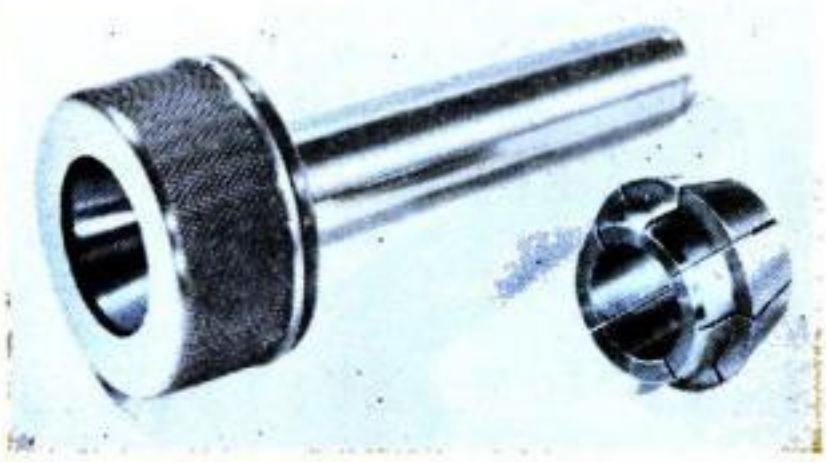
Price includes one blade .020" thick. Extra cutter blades .020" and .015" thick are available as listed below.

Size of Lathe	9"		10"		13"		14½"		16"	
Description	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price	Cat. No.	Price
Mica Undercutting Attachment	675-N	$19.00	675-R	$19.00	675-T	$20.00	675-F	$21.00	675-H	$22.00
Extra Blade, .015"	2028	.20	2028	.20	2028	.20	2028	.20	2028	.20
Extra Blade, .020"	2029	.30	2029	.30	2029	.30	2029	.30	2029	.30

Adjustable Collet Bushing Chuck

The adjustable collet bushing chuck provides an extremely accurate, but inexpensive equipment for mounting centerless armature shafts, and similar parts, in the lathe. Can be used in either head or tail spindle of lathe. Collets are made of brass, and may be adjusted for either running fit or driving fit on shaft.

Description	Cat. No.	Shank	Price
Adjustable Collet Bushing Chuck Only	1615-NR	No. 2	$6.60
	1615-TH	No. 3	7.15
Adjustable Collet Bushing Chuck with set of 3 collets, 9/16", 5/8" and .637" capacity for popular armatures	1608-NR	No. 2	9.45
	1608-TH	No. 3	9.95



Cat. No. 1659, Extra Collets for round work, any capacity ¼" to 1" round by 16ths, price each $1.10.

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Accessories for South Bend Lathes

DESCRIPTION	9"	10"	13"	14½"	16"
Bench, angle iron with 26" x 60" wood top, no drawers...	$32.75	$.....	$.....	$.....	$.....
Bench Drawer, 20" x 14" x 3 3/16", for above bench.....	6.25	.....	.....	.....	.....
Bench, tubular steel with 27" x 51 ½" top and six drawers..	135.00	.....	.....	.....	.....
Center Knock-out Bar, with knurled handle and brass tip..	2.65	3.25*	4.75*	4.75*	4.75
Chuck, face plate type, with four jaws.....	15.75	20.00*	.....	.....	.....
Chuck, 1/8" to 5/8" Hollow Threaded for holding auto. valves.	15.00	.....	.....	.....	.....
Chuck, 3/16" to 3/4" Hollow Threaded for holding auto. valves.	18.00	.....	.....	.....	.....
Chuck, 6" Independent 4-jaw, medium pattern.....	32.50	38.50*	.....	.....	.....
Chuck, 6" Independent 4-jaw, regular pattern.....	60.00	66.00*	66.00*	.....	.....
Chuck, 7½" Independent 4-jaw regular pattern.....	.....	73.00*	73.00*	74.00*	74.00
Chuck, 9" Independent 4-jaw, regular pattern.....	.....	.....	80.00*	81.00*	81.00
Chuck, 10" Independent 4-jaw, regular pattern.....	.....	.....	.....	93.00*	93.00
Chuck, 12" Independent 4-jaw, regular pattern.....	.....	.....	.....	.....	107.00
Chuck, 5" Universal 3-jaw med. pattern, with two sets jaws.	47.22	53.22*	.....	.....	.....
Chuck, 5" Universal 3-jaw, reg. pattern, with two sets jaws.	75.00	81.00*	81.00*	82.00*	82.00
Chuck, 6" Universal 3-jaw, reg. pattern, with two sets jaws.	.....	84.00*	84.00*	85.00*	85.00
Chuck, 7½" Universal 3-jaw, reg. pattern, with two sets jaws	.....	.....	96.00*	97.00*	97.00
Chuck, 9" Universal 3-jaw, reg. pattern, with two sets jaws..	.....	.....	.....	.....	125.00
Chuck, 0 to 3/8" Jacobs Drill, with No. 2 Morse Taper arbor..	6.40	6.40	.....	.....	.....
Chuck, 0 to ½" Jacobs Drill, with No. 2 Morse Taper arbor..	7.74	7.74	.....	.....	.....
Chuck, 3/16" to 3/4" Jacobs Drill, with No. 2 Morse Taper arbor	12.90	12.90	.....	.....	.....
Chuck, 3/8" to 1" Jacobs Drill, with No. 2 Morse Taper arbor.	20.90	20.90	.....	.....	.....
Chuck, 0 to 3/8" Jacobs Drill, with No. 3 Morse Taper arbor..	.....	.....	6.85	6.85	6.85
Chuck, 0 to ½" Jacobs Drill, with No. 3 Morse Taper arbor..	.....	.....	8.19	8.19	8.19
Chuck, 3/16" to 3/4" Jacobs Drill, with No. 3 Morse Taper arbor	.....	.....	13.35	13.35	13.35
Chuck, 3/8" to 1" Jacobs Drill, with No. 3 Morse Taper arbor.	.....	.....	21.35	21.35	21.35
Cutter Bits, high speed steel, to fit turning tool holders.....	.25	.25	.35	.55	.55
Diamond Dresser and holder for truing grinding wheels...	13.25	13.25	14.25	14.25	15.25
Die Holder with No. 2 M. T. shank, for 1½" round dies....	4.25	4.25	.....	.....	.....
Die Holder with No. 3 M. T. shank, for 1½" round dies....	.....	.....	4.75	4.75	4.75
Double Tool Cross Slide, screw feed type.....	.....	.....	.....	.....	131.00
Gauge, for grinding lathe tool cutter bits.....	.50	.50	.50	.50	.50
Metric Transposing attachment, Quick Change Gear Lathe.	11.00	42.00	47.00	53.00	58.00
Metric Transposing attach., Standard Change Gear Lathe.	13.00	.....	.....	.....	.....
Reamer and cutter grinding stops, for use with grind. attach.	16.00	17.00	19.00	21.00	21.00
Tailstock, handlever type, in addition to regular T. S.....	84.00	100.00	.....	.....	.....
Tailstock, handlever type, in lieu of regular T. S.....	63.00	74.00	.....	.....	.....
Tool, boring, style "B" with sleeve bar and two cutter bits..	6.53	6.53	7.73	10.20	10.20
Tool, boring, style "D" with solid boring bar.....	4.13	4.13	4.80	6.00	6.00
Tool, left hand turning, with cutter bit and wrench.....	1.67	3.80	4.33	5.33	5.33
Tool, right hand turning, with cutter bit and wrench.....	1.67	3.80	4.33	5.33	5.33
Tool, straight shank turning, with cutter bit and wrench...	1.67	3.80	4.33	5.33	5.33
Tool, knurling, with medium diamond knurls.....	4.00	7.53	9.00	10.66	10.66
Tool, left hand cut-off, with cutter blade and wrench.....	.....	3.80	4.80	6.00	6.00
Tool, right hand cut-off, with cutter blade and wrench.....	2.00	3.80	4.80	6.00	6.00
Tool, straight shank cut-off, with cutter blade and wrench..	2.00	3.80	4.80	6.00	6.00
Tool, threading, with 60° formed cutter.....	3.33	5.53	6.67	8.53	8.53
Turret, turnstyle operated, for lathe bed.....	.....	.....	.....	.....	525.00

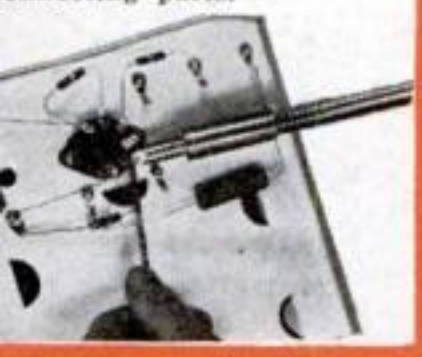
***These prices are for 1" Collet Lathes. Prices for regular lathes are slightly less.**

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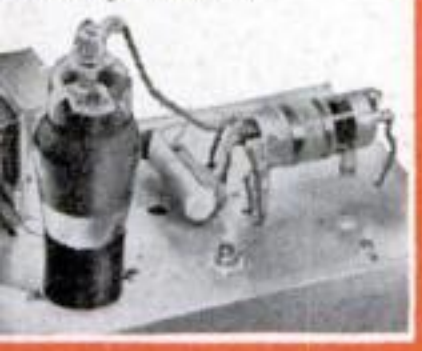
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